ENHANCING EMPLOYEE WELLNESS:

TRANSLATING AN EFFECTIVE COMMUNITY BEHAVIORAL WEIGHT LOSS TREATMENT TO THE WORKSITE

A DISSERTATION SUBMITTED TO THE UNIVERSITY OF HAWAI'I AT MĀNOA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

PSYCHOLOGY

NOVEMBER 2016

By

Jessica M. Murakami

Dissertation Committee:

Janet D. Latner, Chairperson
Jack Barile
David Cicero
Frank Floyd
Claudio Nigg

Keywords: Obesity, worksite, Diabetes Prevention Program, social support

Acknowledgements

I would like to gratefully acknowledge the generous funding support of the Hawaii Medical Services Association (HMSA), which enabled this research. I also express my heartfelt thanks to Doug Jeffs and the HMSA Innovation Department for their support of this study as well a special thank you to all of the HMSA employees who participated in the HMSA Lifestyle Balance Project. I also would like to express my immense gratitude to Emily Stefano and Devin Rand-Giovannetti, who generously gave their time to serve as co-leaders for the intervention, as well as the undergraduate research assistants who devoted time to this project, especially Yuna Martin, Kendall Oshiro, Chelsea Miyashiro, and Rachel Gibson.

There are so many friends and colleagues whose support has been invaluable throughout my graduate education that I would like to thank, especially Jamal Essayli, Francoise Acra, Dana Arakawa, Corey Flanders, and Ashley Anglin. Equally generous have been non-psychology friends and family who supported me all along this journey, especially my partner, Samuel Suen, and my parents, Joseph and Joy Murakami, who I have always been able to rely on in this and every other endeavor.

I would especially like to thank the members of my committee and my clinical mentors through the years who have all contributed immensely to this project as well as my pursuit of clinical psychology over the past six years. I would especially like to acknowledge and thank my graduate school advisor, Dr. Janet Latner, for her help in the preparation of this manuscript and for her guidance and support in this amazing journey.

Abstract

Objective: As rates of obesity continue to rise in the United States, there is a need for effective treatments for excess adiposity. Behavioral weight loss interventions such as the Diabetes Prevention Program can produce clinically meaningful weight reduction through lifestyle modifications that include improving diet and physical fitness. Previous research has demonstrated the efficacy of these interventions when delivered at community sites and jobsites. However, few studies have evaluated the effectiveness of high-intensity behavioral weight loss interventions at Hawaii worksites. This research investigated the effectiveness of a previously validated behavioral weight loss intervention called the Lifestyle Balance Program in a Hawaii worksite.

Method: Thirty-six participants with a body mass index ≥ 25 were recruited from the employee population of a local employer. Participants received 6 months of group behavioral weight loss treatment from trained providers. Anthropomorphic, physiological, psychological, and behavioral assessments were collected at pre-treatment and post-treatment. Additionally, select physiological and behavioral assessments were collected every four sessions. Data collected from workplace participants was compared to previously collected data from community participants.

Results: Sixty-one percent of participants adhered to treatment and 78% of participants completed treatment. From pre-treatment to post-treatment, participants achieved clinically significant improvements in weight, body mass index (BMI), and waist circumference, with accompanying physiological, psychological and behavioral improvements. Repeated measures analyses revealed that participants achieved significant changes in weight, body mass index, and waist circumference across time points, as well as improvements in specific eating habits across time points.

Conclusion: The present study adds to the literature supporting the effectiveness of worksite behavioral weight loss programs and indicates that such programs may produce clinically significant weight losses for a large proportion of participants, accompanied by significant improvements in physiological, behavioral and psychological outcomes that occur over the course of treatment. In light of the severe consequences of the obesity epidemic, this research is promising for the ongoing implementation of behavioral weight loss approaches.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation	Term
ANOVA	Analysis of variance
BMI	Body mass index
BSQ	Body Shape Questionnaire
CDC	Centers for Disease Control
DPP	Diabetes Prevention Program
FFQ	Food Frequency Questionnaire
HbA1c	Hemoglobin A1c
HDL	High-density lipoprotein
HMSA	Hawaii Medical Services Association
HMSA-LBP	Hawaii Medical Services Association Lifestyle Balance Program
IPAQ	International Physical Activity Questionnaire
ITT	Intent-to-treat
IWQOL	Impact of Weight on Quality of Life-Lite Scale
LDL	Low-density lipoprotein
MANOVA	Multiple analysis of variance
NHANES	National Health and Nutrition Examination Survey
RCT	Randomized control trial
WMSI	Weight Management Support Inventory

CHAPTER 1. INTRODUCTION

Obesity and Its Consequences

Obesity is commonly labeled one of the greatest health crises in the United States (Oliver, 2006) with nearly 70% of American adults classified as either overweight (Body Mass Index [BMI] greater than or equal to 25 kg/m^2) or obese (BMI greater than or equal to 30 kg/m^2; Flegal, Carroll, Kit, & Ogden, 2012). In Hawaii, 55.9% of adults are overweight or obese, and these rates reflect a dramatic increase in excess adiposity over the last decade (Levy et al., 2013). These statistics are especially alarming as a substantial body of medical research links excess adiposity to increased vulnerability to acute and chronic disease (e.g., Bray, 2004; Calle, Thun, Petrelli, Rodriguez, & Heath, 1999; Calle, Rodriguez, Walker-Thurmond & Thun, 2003; Lawrence & Kopelman, 2004). Specifically, obesity is associated with a myriad of health consequences, including diabetes mellitus, metabolic syndrome, cardiovascular disease, hypertension, stroke, peripheral vascular disease, dyslipidemia, metabolic syndrome, sleep apnea, glomerulopathy, cholelithiasis, nonalcoholic fatty liver disease, osteoarthritis, and certain forms of cancer (Kim & Popkin, 2006; Klein et al., 2004; Lewis et al., 2009). Collectively, these adiposity-related health conditions decrease the mean lifespan in America by as much as 5 years (William, Mesidor, Winters, Dubbert, & Wyatt, 2014; Wyatt, Winters & Subbert, 2006).

There is also considerable literature supporting that obesity is linked to negative psychological consequences, including poorer health-related quality of life (e.g., Fontaine, Cheskin, & Barofsky, 1996; Sarlio-Lahteenkorva, Stunkard, & Rissanen, 1995; Sullivan, Sullivan, & Kral, 1987), and a lessened sense of psychological well-being (Fontaine et al., 1996; Sullivan et al., 1993; Friedman & Brownell, 1995). Additionally, overweight and obese individuals are often the target of weight-based stigmatization (Puhl & Heuer, 2009; Puhl &

Latner, 2007), with negative stereotypes of laziness, incompetence, sloppiness, social ineptitude, intellectual inferiority, poor self-esteem, and poor self-control commonly applied to individuals with obesity (Allon, 1982; Harris, 1990; Puhl & Brownell, 2001). Weight stigma carries additional consequences, including increasing vulnerability to low self-esteem, depression, anxiety, and disordered eating (Fabricatore & Wadden, 2006; Puhl & Latner, 2007).

As the evidence overwhelmingly supports that excess adiposity contributes to detriments in physical and psychological health, it is not surprising that the burden of excess weight has negative economic impacts. The medical costs associated with excess adiposity are substantial (Hammond & Levine, 2010; Wolf, 1998), with overweight and obese individuals incurring significantly higher annual healthcare costs compared to normal-weight individuals (Finkelstein, Trogdon, Cohen, & Dietz, 2009; Thompson, Brown, Nichols, Elmer, & Oster, 2001). Research examining medical spending indicates that these costs have risen sharply over time—in 2002, medical expenditure attributable to overweight and obesity was estimated at $92.6 billion dollars per year (Finkelstein, Fiebelkorn, & Wang, 2003); in 2008, this number climbed to an estimated $147 billion per year (Finkelstein et al, 2009); and in 2013, expenditures were estimated as high as $210 billion per year (Robert Wood Johnson Foundation and the Trust for America's Health, 2013). Alarmingly, if present trends continue, the economic burden of excess adiposity may grow to even more troubling proportions, with some economists estimating that by 2030, approximately one-sixth of healthcare expenses (estimated between $860.7 to $956.9 billion) in the United States will be spent on weight-related health care (Wang et al., 2008; 2011).

Given the substantial and alarming evidence of the impacts of obesity, the importance of successful and sustained weight loss treatment is increasingly evident. Encouragingly, research has demonstrated that even a modest weight loss of as little as 5% of total body weight is

associated with significant health gains, including notable decreases in risk factors associated with cardiovascular disease, diabetes mellitus, metabolic syndrome, and hypertension (Ditschuneit, Frier, & Flechtner-Mors, 2002; Mertens & Van Gaal, 2000; Powell, Calvin, & Calvin, 2007; Tuomileho et al., 2001; Wing et al., 2011). There is also evidence that modest weight reductions mitigate the negative psychological effects of excess adiposity. Individuals who achieved modest weight reductions reported improved mood, body image, self-esteem, and quality of life, as well as improvement of depressive symptoms (e.g., Blaine, Rodman, & Newman, 2007; Maciejewski, Patrick, & Williamson, 2005; Simon et al., 2010; Wadden, Foster, & Letizia, 1994; Wadden et al., 2004; Wing, Epstein, Marcus, & Kupfer, 1984). Accordingly, modest weight loss would result in substantial economic benefits, including reductions in total annual medical and productivity costs (Trogdon, Finkelstein, Reyes, & Dietz, 2009). While eliminating overweight and obesity may yield the greatest benefits, interventions that produce moderate weight reductions may be a more realistic approach to mitigating the negative impact of obesity in the United States.

Behavioral Weight Loss Interventions

Behavioral weight loss interventions for obesity are an approach to weight management that has extensive evidence of efficacy. Across numerous studies and systematic reviews, behavioral weight loss produces clinically meaningful weight losses of 5 to 10% (e.g., Fabricatore & Wadden, 2006; Powell et al., 2007) and is recommended as the first line of intervention for overweight and obese individuals (Butryn et al., 2011; Jensen et al., 2014).

Based on a systematic review of 146 qualifying publications examining comprehensive lifestyle modification programs for overweight and obese adults, the Obesity Expert Panel of the National Lung, Blood, and Heart Institute concluded that the most effective behavioral weight

loss treatments consist of in-person, high-intensity (i.e., >14 sessions in 6 months) comprehensive weight loss interventions provided by a trained interventionist (Jensen et al, 2014). Additionally, the Panel stated that the principal components effective behavioral weight loss lifestyle interventions include 1) prescription of a moderately reduced-calorie diet (a diet designed to induce an energy deficit of >500kcal per day), 2) a program of increased aerobic physical activity (such as brisk walking for >150 minutes per week or >30 minutes on most days), and 3) the use of behavioral strategies to facilitate adherence to diet and activity recommendations (goal setting, self-monitoring, and stimulus control; Jensen et al, 2014). The Diabetes Prevention Program (Diabetes Prevention Program Research Group, 2002) is a lifestyle modification intervention that meets these criteria and is widely considered an exemplar of behavioral weight loss programs (Butryn et al., 2011). Given the heterogeneity among behavioral weight loss programs (Jensen et al., 2014), the Diabetes Prevention Program represents a well-evaluated treatment package that has demonstrated efficacy in both individual and group settings (e.g., Baker, Simpson, Lloyd, Bauman, Singh, 2011; Diabetes Prevention Research Group 1999; 2002; Knowler et al., 2009).

Despite having a great deal of empirical support, comprehensive behavioral weight loss treatments like the Diabetes Prevention Program are limited by high attrition rates of up to 20 to 45% (Butryn et al., 2011). Furthermore, only 20 to 40% of behavioral weight loss patients sustain weight loss for two years or more (Fabricatore & Wadden, 2006; Powell et al., 2007) and obese individuals are found to seek repeated weight loss treatments (Ciao, Latner, & Durso, 2012). Given the rates of dropout and weight regain, researchers have hypothesized that increasing social support may be key to increasing the proportion of patients who are able to achieve and maintain weight loss (DePue, Clark, Ruggiero, Medeiros, & Pera, 1995). Kalodner

& DeLucia (1990) noted that group support is positively correlated with weight loss. Research by Wing and Jeffery (1999) indicates that shared environments and shared social support groups decrease treatment dropout rates and increase successful weight maintenance post-treatment. The evidence also shows that group-based weight loss programs produce superior results compared to individual participation programs due to improved social support (Heshka et al., 2003; Jeffery et al., 1983; Renjilian et al., 2001). Therefore, in order to increase the likelihood of weight maintenance and utilize the enhancing effects of shared environments and support, behavioral weight loss programs that were originally tested in academic medical center and research university settings were adapted and evaluated in community settings.

Three systematic reviews have been conducted examining the Diabetes Prevention Program behavioral weight loss treatments in a variety of community settings, including community centers, primary care centers, community organizations and churches (Ali, Echouffo-Tcheugui, & Williamson, 2012; Jackson, 2009; Whittemore, 2011). Table 1 provides an overview of studies supporting the effectiveness of group, community-based Diabetes Prevention Program, as reviewed by Jackson (2009), Whittemore (2011), and Ali and colleagues (2012). Across these systematic reviews, researchers concluded that community-based translations of the Diabetes Prevention Program are generally successful in producing clinically significant weight loss, reduction in risk factors for diabetes, and reduction of metabolic syndrome components (Ali et al., 2012; Jackson, 2009; Whittemore, 2011).

In addition to promising outcomes from effectiveness studies across the United States studies, preliminary work has demonstrated that community-based behavioral weight loss may be effective in the state of Hawaii. For example, researchers in Hawaii (Mau et al., 2010;

Table 1
Studies evaluating group community-based Diabetes Prevention Program (DPP) translations

Author	Study Design & Description	Sample Characteristics (n, gender, mean age in years [SD]) if available	State & Intervention Setting	Post-treatment Outcomes
Mayer-Davis et al., 2004[1]	Randomized control trial, 3 arms: intensive lifestyle intervention (based on DPP), reimbursable-lifestyle intervention, and usual care 16 mixed group and individual sessions Instructor: nutritionist	152 adults with Type II diabetes and overweight 80% female participants	Rural primary health care centers	**Intensive Lifestyle Intervention** -0.97 kg/m^{2a} Decrease in mean hemoglobin A1c **Reimbursable lifestyle intervention:** -0.29 kg/m^2 Decrease in mean hemoglobin A1c **Usual care control:** -0.16 kg/m^2 Decrease in mean hemoglobin A1c, decrease in systolic blood pressure
Ackermann & Marrero, 2007[1]; Ackermann et al., 2008[2,3]	Matched-pair, group-randomized intervention, 2 arms: DPP intervention and advice alone (control) 16 group sessions Instructor: YMCA staff with health degree	92 overweight adults at high risk for pre-diabetes 61% female participants (control) 50% female participants (intervention) 60.1 (±10.5) years (control), 56.5 (±9.7) years (intervention)	Indiana Semiurban YMCA	**Intervention:** -6% original body weight[b] Decrease in mean cholesterol **Control:** -2% original body weight[b]
Davis-Smith, 2007[1, 2, 3]	Nonrandomized prospective intervention 6 group sessions Instructor: volunteer health care professional	10 adults with pre-diabetes 70% female participants	Georgia Rural African American church	**Post Intervention:** -3.99 (±5.00) kg[a] Decrease in BMI, fasting glucose, systolic and diastolic blood pressure

Note. [1]Reviewed in Jackson (2011); [2]Reviewed in Whittemore (2011); [3]Reviewed in Ali et al. (2012)
All outcomes listed are statistically significant, except change in weight (significance will be indicated separately.)
[a] Significant difference from baseline. [b] Significant between-group difference.

Table 1, continued

Studies evaluating group community-based Diabetes Prevention Program (DPP) translations

Author	Study Design & Description	Sample Characteristics (n, gender, mean age in years [SD]) if available	State & Intervention Setting	Post-treatment Outcomes
Boltri et al., 2008[2, 3]	Nonrandomized prospective intervention 16 group sessions Instructor: volunteer health professional with diabetes prevention experience	8 adults 58% female participants 52 years	Georgia Semi-urban African American church	**6 months Post Intervention:** -2.6 kg Decrease in glucose and blood pressure
Seidel et al., 2008[1, 2, 3]	Nonrandomized prospective intervention 12 group sessions Instructors: dietician, exercise instructor	88 adults with 3 of 5 components of metabolic syndrome, overweight 54.00(±10.5) years 84.1% female participants	Pennsylvania Urban, medically underserved community hospital	**3 months Post Intervention:** 46.4% lost 5%, 26.1% lost 7%[a] Decrease in abdominal obesity, HDL, hypertension, triglycerides, fasting glucose
Amundson et al., 2009[3]	Four-site nonrandomized prospective intervention 16 group sessions + optional structured physical activity Instructor: volunteer health professional	355 overweight and obese adults with 1+ risk factor(s) for type II diabetes or cardiovascular disease 90% female 53.6(±9.7) years	Montana Urban healthcare facility	**Post Intervention** -6.7 (± 4.0) kg[a] Decrease in BMI, increase in physical activity
Kramer et al., 2009[3]	Two nonrandomized prospective interventions 12 group sessions Instructor: prevention professionals	**Phase 1** 51 overweight and obese adults with 3+ criteria of metabolic syndrome 82% female participants 52.9(±12.3) years **Phase II** 42 pre-diabetic adults 79% female participants 57.2(±9.7) years	Pennsylvania Rural and urban primary care centers	**Phase I: 3 months Post Intervention** -2.1 (±3.2) kg[a] Decrease in waist circumference, BMI, fasting glucose **Phase II: 3 months Post Intervention** -4.5 (±3.6) kg[a] Decrease in waist circumference, BMI, total cholesterol, systolic and diastolic blood pressure

Note. [1]Reviewed in Jackson (2011); [2]Reviewed in Whittemore (2011); [3]Reviewed in Ali et al. (2012)
All outcomes listed are statistically significant, except change in weight (significance will be indicated separately.)
[a] Significant difference from baseline. [b] Significant between-group difference.

Table 1, continued

Studies evaluating group community-based Diabetes Prevention Program (DPP) translations

Author	Study Design & Description	Sample Characteristics (n, gender, mean age in years [SD]) if available	State & Intervention Setting	Post-treatment Outcomes
Matvienko & Hoehns, 2009[2, 3]	Nonrandomized prospective intervention 16 group sessions Instructor: exercise science graduate students	31 overweight and obese and/or pre-diabetic and diabetic adults 55.8(±8.9) years	Iowa University campus	**6 months Post Intervention:** -6.1 (±0.9) kg[a] Decrease in BMI, waist & hip circumference, diastolic blood pressure
Doldani & Fields, 2010[2]	Nonrandomized prospective intervention 12 group sessions Instructor: volunteer health professional	40 overweight and obese adults 85.3% female participants 46.0(±9.6) years	Semi-urban African American church	**Post Intervention:** 48% lost at least 5% of baseline weight, 26% lost 7% or more, and 14% lost >10% of baseline weight
Faridi , 2010[3]	Nonrandomized controlled study Group session varied between organizations Instructor: volunteer health advisors	121overweight and obese adults at risk for type II diabetes	Connecticut Urban African American churches	**Post Intervention:** Increase in diabetic knowledge, decrease in total calories consumed[a] Increase in energy expenditure and nutrition self efficacy[b]
Kramer et al., 2010[3]	Nonrandomized prospective intervention 12 group sessions Instructor: trained prevention specialists	26 adults with pre-diabetes or metabolic syndrome 70.8% female 61.0 years	Pennsylvania Community primary care centers	**Post Intervention:** -13.89(±14.34) lb[a] Decrease in BMI, waist circumference, hemoglobin A1c, systolic and diastolic blood pressure, increase in physical activity
Mau et al., 2010[2, 3]	Nonrandomized prospective intervention 8 group sessions Instructor: community peer educators	239 overweight and obese adults 83% female participants 49.0(±14.0) years	Hawaii Native Hawaii and Pacific Islander community organizations	**3 months Post Intervention:** -1.5 (±1.5) kg[a] Decrease in blood pressure, dietary fat intake, Increase in physical functioning, physical activity

Note. [1]Reviewed in Jackson (2011); [2]Reviewed in Whittemore (2011); [3]Reviewed in Ali et al. (2012)
All outcomes listed are statistically significant, except change in weight (significance will be indicated separately.)
[a] Significant difference from baseline. [b] Significant between-group difference.

Table 1, continued

Studies evaluating group community-based Diabetes Prevention Program (DPP) translations

Author	Study Design & Description	Sample Characteristics (n, gender, mean age in years [SD]) if available	State & Intervention Setting	Post-treatment Outcomes
Parikh , 2010[3]	Group-randomized intervention, 2 arms: DPP intervention and waitlist control 8 group sessions Instructor: lay leaders with supervision of experts	99 overweight and pre-diabetic adults 84% female participants (control) 86% female participants (intervention) 50 (±18) years (control), 46 (±15) years (intervention)	New York Urban community organizations	**Intervention:** -7.2(±7.3)[b] **Control:** -2.4(±8.1) lb[b]
Boltri et al., 2011[3]	Nonrandomized prospective intervention 6-16 group sessions Instructor: volunteer with medical or psychology background	37 adults with pre-diabetes 62.2% female 57.2(±9.0) years	Georgia Semi-urban African American churches	**Post Intervention:** -3.8(±6.5) kg[a] Decrease in BMI and fasting glucose
Jaber et al., 2011[3]	Nonrandomized prospective intervention 12 group sessions Instructor: dieticians and nurses	71 overweight and obese adults 62% female 47.0(±9.4) years	Michigan Urban Arab American community organization	**Post Intervention:** -5.2(±4.4) kg[a] Decrease in BMI, waist and hip circumferences Increase in physical activity
Katula , 2011[3]	Group-randomized intervention, 2 arms: DPP intervention and enhanced usual care control 24 group sessions + 3 individual sessions with registered dietician Instructor: community health workers	301 overweight and obese adults with pre-diabetes 151 intervention, 150 control 57.3% female participants (control) 57.6% female participants (intervention) 58.5 (±9.0) years (control), 57.3 (±10.1) years (intervention)	North Carolina Community parks/recreation centers	**Post Intervention:** Between group difference in weight, BMI, waist circumference, fasting glucose, insulin

Note. [1]Reviewed in Jackson (2011); [2]Reviewed in Whittemore (2011); [3]Reviewed in Ali et al. (2012)
All outcomes listed are statistically significant, except change in weight (significance will be indicated separately.)
[a] Significant difference from baseline. [b] Significant between-group difference.

Kaholokula et al., 2014) successfully adapted a community-based version of the Diabetes Prevention Program for Native Hawaiian, Filipino, and Pacific Islander communities. This intervention, known as the PILI Ohana Project, consisted of eight group sessions that lasted between sixty and ninety minutes over three months and was culturally adapted specifically for individuals of Native Hawaiian, Filipino, or other Pacific Islander ethnic background. This intervention was piloted (Mau et al., 2010) and replicated in a larger sample (Kaholokula et al., 2014), and in both trials the PILI Ohana Project produced significant decreases in body weight, blood pressure, and intake of dietary fat as well as significant increases in physical functioning and physical activity.

Similarly, Latner and colleagues (2013) adapted the manual for the Diabetes Prevention Program's curriculum, known as the Lifestyle Balance Program, to create a 20-session behavioral weight loss intervention for Hawaii-based community organizations. This group intervention was administered to 90 overweight and obese participants at a variety of religious and community organizations on the island of O'ahu. Seventy-nine percent of participants completed treatment. At post-treatment, the intervention produced positive results, with participants achieving clinically significant weight losses and significant improvements in physiological measures of triglycerides, total cholesterol, HDL, LDL, and blood sugar. Additionally, participants achieved behavioral and psychological improvements in eating patterns, physical activity level, quality of life, and body image. All improvements were sustained at 6- and 18-month follow up.

The implementation of these community-based treatments is consistent with a social ecology model of health promotion (Stokols et al., 1992; Stokols, Grzywacz, McMahan, & Phillips, 2003). Drawing heavily on systems theory (Boulding, 1956), the social ecology model

for health promotion operates on four assumptions: (1) health behavior is influenced by physical and social environments, as well as personal attributes; (2) environments are multidimensional and interdependent; (3) human-environment interactions occur at varying levels; and (4) people influence their settings and changed settings influence behavior. According to social ecological theory, everyday human patterns occur in highly structured environmental settings and life domains referred to as "leverage points." As leverage points exert varying influence on personal and collective behavior, targeting high-impact leverage points with health promotion interventions is recommended (Stokols, 1996). The positive results of community-based treatments may reflect the efficacy of addressing health behavior leverage points at a social and environmental level (DeJoy & Southern, 1993; Stokols, Pelletier, & Fielding, 1996).

In the context of the social ecology model, the modification of the obesogenic social and physical environment at the community level should enhance weight management efforts. Encouragingly, the existing evidence supports that a community-based model of treatment can be effective in producing sustained weight losses (Ali et al., 2012; Jackson, 2009; Whittemore, 2011). However, more research is necessary to determine what other high-impact leverage points (Stokols, 1996) may be effectively targeted to combat obesity.

Worksite Interventions

The worksite is often a highly structured environmental setting and may be a promising leverage point to implement weight loss interventions. Consistent with the social ecology model, there is evidence that employees are more likely to modify their own personal health behaviors to replicate a healthy worksite environment (Golaszewski, Barr, & Pronk, 2003), which may contribute to continued positive efforts outside of the work environment. Additionally, the average American employee spends more time at work than in past years (Soler et al., 2010) and

therefore may receive more consistent and long-term social support from coworkers and peers. Social support is a strong determining factor in successful behavior change (Brownell, Cohen, Stunkard, Felix, & Cooley, 1984; Dishman, Oldenburg, O'Neal, & Shephard, 1998; Hoke & Franks, 2002; Miller & Edelstein, 1990; Peregrin, 2005). Similar to community settings, worksite interventions could potentially utilize existing channels of communication, protocol, and social networks to produce an environment supportive of weight loss (Allen & Allen, 1985; Katz et al., 2005). For these reasons, it is possible that workplace interventions could be effective for weight loss interventions due to factors like shared environment, camaraderie, and availability of social support.

Employers may also benefit from implementing worksite weight management interventions. It is estimated that 34% for the workforce is overweight and nearly 30% is obese (Hertz et al., 2004), and excess adiposity is associated with decreased productivity and increased absenteeism, disability, workers' compensation claims, and early retirement (Finkelstein et al., 2005; Finkelstein, DiBonaventura, Burgess, & Hale, 2010; Popkin, Kim, Rusev, Du, & Zizza, 2006; Trogdon, Finkelstein, Hylands, Dellea, & Kamal-Bahl, 2008; Wang et al., 2011). Additionally, employers bear the majority of increasing healthcare costs with approximately 20 to 30% of employer healthcare costs attributable to modifiable health risks such as obesity (Finkelstein et al., 2005; Thygeson, 2010; Yen, Schultz, Schnueringer, & Edington, 2006). By offering weight management in the worksite, employers may have the potential to improve employee risk profiles, decrease healthcare costs (Goetzel, Hawkins, Ozminjowski, & Wang, 2003), and generate a positive return on investment (Bachman, 2007; Ominkowski et al., 2002; Trogdon et al., 2009). For example, the costs of short- and long-term disability absence days are lower for employees participating in worksite health-promotion programs than for those not

participating (Schultz et al., 2002). Similarly, the preliminary research also indicates that workplace health-promotion programs can positively affect on-the-job productivity (Cancelliere, Cassidy, Ammendolia, & Cote, 2011).

The existing literature supports the effectiveness of worksite health promotion for weight management. A 2005 systematic review of 20 studies examining public health strategies to prevent and address overweight and obesity concluded that worksite interventions are the only population-based interventions with sufficient evidence of effectiveness to warrant recommendation (Katz et al, 2005). However, this review defined effectiveness exclusively as achievement of weight loss of four pounds or more, without taking into consideration other outcomes, such as dietary intake and exercise. Another review of 11 worksite-based weight loss programs by Benedict and Arterburn (2008) concluded that such interventions produce modest weight loss. A third systematic review by Anderson and colleagues (2009) pooled data from 47 worksite nutrition and physical activity intervention studies and found strong evidence of a consistent, but modest, effect of weight loss when interventions were delivered in the worksite. Across these reviews, when more intensive modes of intervention were applied (e.g., structured programs, a degree of behavioral counseling in addition to education), there appeared to be an increase in positive program impact (Anderson et al., 2009; Benedict & Arterburn, 2008; Katz et al., 2005). However, all three reviews indicated that there is insufficient evidence to draw conclusions about the differential effects of program components (e.g., psychoeducation, behavioral skills; Anderson et al., 2009; Benedict & Arterburn, 2008; Katz et al., 2005). Thus, although it appears health promotion for weight management in worksites is generally effective, there is insufficient evidence of the efficacy of intensive behavioral weight loss in the worksite.

More research is necessary to establish utilizing behavioral weight loss treatments at the worksite.

Until recently, few studies evaluated worksite behavioral weight loss programs, with much of the early literature presenting largely mixed results and high attrition rates (e.g., Abrams & Follick, 1983; Brownell, Stunkard, & McKeon, 1985; Stunkard & Brownell, 1980). Over the last decade, several studies have emerged evaluating worksite-based Diabetes Prevention Program translations with more promising findings. While one study found that a worksite Diabetes Prevention Program translation produced no weight loss (Wilson et al., 2016), eight studies support the effectiveness of these interventions for producing weight loss in a variety of worksite settings (Aldana et al., 2005; Aldana et al., 2006; Barham et al., 2011; Dallam & Foust, 2013; Giese & Cook, 2014; Kramer et al., 2015; Townsend et al., 2016; Weinhold et al., 2015). Table 2 summarizes the findings of studies evaluating the effectiveness of worksite-based Diabetes Prevention Program translations.

In the state of Hawaii, only two major studies have examined worksite weight loss program and this research has produced mixed results. Williams and colleagues (2007; 2014) conducted the largest of these studies, recruiting 11,559 participants to conduct a group-randomized worksite obesity prevention and intervention trial in 31 O'ahu hotels. In this study, hotels were pair-matched (workforce size, luxury status, union status) and randomly assigned to either a minimal intervention condition or an intensive intervention condition. Participants in the minimal intervention condition received brief feedback on weight and lifestyle choices on three occasions over 24 months. Participants in the intensive intervention condition received the same feedback and advice given to the minimal intervention participants in addition to two years of

Table 2
Studies evaluating group worksite-based Diabetes Prevention Program (DPP) translations

Author	Study Design & Description	Sample Characteristics (n, gender, mean age in years [SD]) if available	State & Intervention Setting	Attrition Rate	Post-treatment Outcomes
Aldana et al., 2005; 2006	Nonrandomized prospective intervention 24 group sessions + 4 individual sessions	37 participants with pre-diabetes or diabetes 65.7% female participants 46 years	Utah Medical supply company	-6%	Post Intervention: -6.3 lbs[a] Decrease in BMI, waist circumference, fasting glucose, insulin, cholesterol, triglycerides Increase in physical activity
Barham et al., 2011	Randomized control trial, 2 arms: intervention and waitlist control 12 group sessions	Intervention: 21 participants at risk for diabetes 87% female participants 51.1 (± 9.6) years Control: 29 participants at risk for diabetes 87% female participants 51.2 (±6.4) years	New York County offices	-9%	Post Intervention: -2.3 kg[b] Decrease in BMI, waist circumference, dietary fat consumption Increase in physical activity, health-related quality of life, functional eating patterns Post Control: +0.73 kg[b] Decrease in fasting glucose
Dallam & Foust, 2013	3 group quasi-experimental intervention based on DPP: one-on-one education cluster, support group cluster, passive intervention (control) 26-week DPP curriculum Instructor: professional interventionists	264 participants	Colorado 4 organizations (newspaper publisher, city/county health department, public hospital, city/county police department)	-42.8% (all groups)	Post intervention (all groups) Decrease in weight[a] Decrease in blood pressure, diabetes risk score Increase in physical activity

Note. All outcomes listed are statistically significant, except change in weight (significance will be indicated separately.)
[a] Significant difference from baseline. [b] Significant between-group difference.

Table 2, continued

Studies evaluating group worksite-based Diabetes Prevention Program (DPP) translations

Author	Study Design & Description	Sample Characteristics (n, gender, mean age in years [SD]) if available	State & Intervention Setting	Attrition Rate	Post-treatment Outcomes
Giese & Cook, 2014	Nonrandomized prospective intervention 16 group sessions Instructor: employee dietician	47 overweight and obese participants 89% female participants	New Mexico Manufacturing plant	-25%	Post Intervention: Decrease in weight [a]
Kramer et al., 2015	Randomized control trial, 2 arms: intervention and usual care control 16 group sessions + 6 maintenance sessions Instructor: professional interventionists	Intervention: 60 overweight and obese participants Control: 29 overweight and obese participants 55% female participants 52.3 (±7.2) years	Pennsylvania Pharmaceutical manufacturing campus	Intervention: -6.6% Control: -3.5%	Post Intervention: -10.4(±8.7) lb[ab] Decrease in BMI, waist circumference, fasting glucose, total cholesterol, LDL cholesterol, systolic and diastolic blood pressure, calories consumped, fat consumed Post Control: -2.3(9.1) lb[b] Decrease in fasting glucose
Weinhold et al., 2015	Randomized control trial, 2 arms: intervention and waitlist control 16 group sessions Instructor: trained dieticians	Intervention 35 overweight and obese participants with pre-diabetes 51.6(±9.5) years 80% female participants Control: 34 overweight and obese participants with pre-diabetes 51.0(±8.1) years 79.4% female participants	Ohio University worksite	Intervention: -2.8% Control: -2.9%	Post Intervention: -5.1(±0.6) kg[a] Decrease in BMI, waist circumference, triglycerides, hemoglobin A1c Increase in physical activity Post Control: -0.4(0.6) kg[b] Increase in physical activity

Note. All outcomes listed are statistically significant, except change in weight (significance will be indicated separately.)

[a] Significant difference from baseline. [b] Significant between-group difference.

Table 2, continued
Studies evaluating group worksite-based Diabetes Prevention Program (DPP) translations

Author	Study Design & Description	Sample Characteristics (n, gender, mean age in years [SD]) if available	State & Intervention Setting	Attrition Rate	Post-treatment Outcomes
Townsend et al., 2016	Nonrandomized prospective intervention 8 group sessions Instructor: employee facilitators and external facilitators	275 overweight and obese Native Hawaiian and Pacific Islander participants	Hawaii Native Hawaiian-serving organizations (social service organizations, health centers, Native Hawaiian healthcare systems, academic institutions)	-21%	Post Intervention: -1.2(±2.6) kg[a] Decrease in systolic and diastolic BP Increase in physical activity frequency, dietary fat consumption, perception of family support, eating self efficacy
Wilson et al., 2016	Randomized control trial, 2 arms: intervention and no treatment control 16 group sessions Instructor: trained employee volunteers	Intervention: 498 overweight and obese participants 6.3% female particiants 44 years Control: 533 overweight and obese participants 5.4% female participants 47 years	Georgia Railroad maintenance facilities	~50%	Post Intervention: -1.6 lb Decrease in sedentary activity Post Control: +3.1 lb Decrease in sedentary activity, walking, dietary fat consumption Increase servings of fruits and vegetables consumed

Note. All outcomes listed are statistically significant, except change in weight (significance will be indicated separately.)
[a] Significant difference from baseline. [b] Significant between-group difference.

weekly onsite weight management groups, weekly offsite groups for obese individuals, various environmental initiatives (e.g., health-supportive messages via displays in employee-only areas as well as newsletters and fliers; Williams et al., 2007). The onsite intervention was modeled on successful nutrition-focused and behavioral weight loss interventions, and the 48-week curriculum was adapted from a 60-minute format with evidence of efficacy (Svetkey et al., 2008) to a 30-minute format for administration during employee shift changes and meals (Williams et al., 2014). Sessions were led by nutritional counselors and consisted of interpersonal support and education about diet and physical activity. At the end of the two-year intervention, the intensive intervention produced a decrease in body mass index and waist-to-hip ratio slightly greater than the minimal intervention condition, but these differences were not statistically significant (Williams et al., 2014). Williams and colleagues (2014) hypothesized that these results may be attributed to the relatively low intensity of the Weight Loss Maintenance Trial curriculum and an unstable management environment in many of the target hotels.

More recently, Townsend and colleagues (2016) adapted a community-based Diabetes Prevention Program translation with evidence of efficacy in Native Hawaiian and Pacific Islander communities (Kaholokula et al., 2014; Mau et al., 2010) for worksites. Recruitment occurred at 15 Native Hawaiian-serving organizations across the state of Hawaii, resulting in the enrollment of 275 overweight and obese employees. The worksite intervention, known as PILI@Work, consisted of eight group sessions over three months of culturally adapted Diabetes Prevention Program curriculum. Sessions were led by trained worksite peer facilitators as well as outside facilitators who were trained to deliver the intervention. At post-treatment, PILI@Work achieved statistically and clinically significant decreases in body weight, BMI, systolic and diastolic blood pressure. Additionally participants significantly improved their

physical fitness, increased the frequency of physical activity, decreased dietary fat consumption, and increased perceptions of family support and eating self-efficacy. Encouragingly, these preliminary results may indicate that Diabetes Prevention Program translations for Hawaii worksites may be effective for addressing excess adiposity.

Given the mixed results of the Williams and colleagues and PILI@Work Programs, additional research evaluating the application of behavioral weight loss programs in Hawaii worksites is necessary. Additionally, these studies utilized shorter, less intensive versions of behavioral weight loss curricula, so further research is warranted to investigate the effectiveness of intensive behavioral weight loss programs delivered in worksite settings.

The Current Research

Translations of the Diabetes Prevention Program have demonstrated success in producing weight loss in community settings (Ali et al., 2012; Jackson, 2009; Whittemore, 2011) and these community translations are amenable to adaptation for the worksite (Aldana et al., 2005; Aldana et al., 2006; Barham et al., 2011; Dallam & Foust, 2013; Giese & Cook, 2014; Kramer et al., 2015; Townsend et al., 2016; Weinhold et al., 2015). However, despite recent literature providing promising results for worksite Diabetes Prevention Program translations, more research is necessary to evaluate the efficacy and effectiveness of these interventions, particularly in Hawaii worksites. The aim of the current research was to fill an important gap in the evidence-base for intensive worksite-based Diabetes Prevention Programs in the state of Hawaii. A quasi-experimental single-group repeated measures design was used to replicate and extend the work of Latner and colleagues (2013) and to evaluate the translation of their effective community-based intervention to a Hawaii-based worksite. In order to compare the current

research to previous studies, the Diabetes Prevention Program curriculum adapted by Latner and colleagues (2013) was used with minimal modifications.

Partnership with a worksite. This research was conducted in partnership with the Hawai'i Medical Services Association (HMSA). HMSA is a member of the Blue Cross Blue Shield Association, an association of independent medical insurance providers. As a health insurance organization interested in reducing the economic impacts of preventable illnesses, HMSA was enthusiastic about contributing to evidence-based workplace health promotion research and committed to bringing evidence-based behavioral weight loss to their offices in 2014. As the Diabetes Prevention Program calls their curriculum the Lifestyle Balance Program, the project was called the "HMSA Lifestyle Balance Program" (HMSA-LBP).

To implement the HMSA-LBP, HMSA agreed to provide funding for research materials and laboratory testing, allow recruitment from the HMSA employee pool, and provide meeting space in its Kaka'ako headquarters for group sessions. To help with managerial and logistical support, the HMSA Innovation Office, an office devoted to novel program development and evaluation, committed to financially and logistically supporting this project. The Innovation Office staff helped researchers to navigate the company's employee policies, understand in-house communication protocols and systems, disseminate recruitment materials, communicate with managers about the nature of the study, coordinate employee escorts for study personnel within company facilities (a security requirement), and schedule HMSA meeting rooms for sessions to take place.

Hypotheses. The current research sought to evaluate the effectiveness of a worksite translation of the Diabetes Prevention Program and to examine the role of social support in worksite weight loss programs. Additionally, for exploratory purposes, comparisons between the

original Lifestyle Balance data and the worksite data were conducted. The specific hypotheses for the study are as follows:

Hypothesis 1: Treatment adherence, completion and satisfaction. Although program adherence rates were not typically provided in previous research, based on retention rates from the community-based Lifestyle Balance Program (Latner et al, 2013) and other worksite translations of the Diabetes Prevention Program (Aldana et al., 2005; Aldana et al., 2006; Barham et al., 2011; Dallam & Foust, 2013; Giese & Cook, 2014; Kramer et al., 2015; Townsend et al., 2016; Weinhold et al., 2015), it was hypothesized that the HMSA-LBP would demonstrate adequate participant adherence to the program, defined as at least 50% of participants attending 15 sessions or more of the 20-session curriculum. It was also hypothesized that the HMSA-LBP would demonstrate adequate participant retention, defined as at least 50% of participants completing treatment. Completion of treatment was defined as participant attendance at either session 19 or session 20. Finally, it was hypothesized that the HMSA-LBP would be viewed favorably by program participants, as assessed by post-treatment satisfaction ratings.

Hypothesis 2: Treatment outcomes. As 36.7% of participants in the community Lifestyle Balance Program lost 5% or more of their baseline body weight (Latner et al., 2013), it was hypothesized that the HMSA Lifestyle Balance Program would demonstrate similar effectiveness in a worksite setting with at least 35% of participants achieving clinically meaningful weight losses of 5% or more of baseline weight. Additionally, it was hypothesized that at least 45% of participants would achieve weight losses of 3% or more.

It was also hypothesized that the intervention would result in improvements in weight-related outcomes, physiological outcomes, and behavioral and psychological outcomes, as

measured through post-intervention assessments. It was hypothesized that these changes would occur over time, as measured by monthly assessments of weight, body composition, waist circumference, eating habits, and physical activity.

Hypothesis 3: Social support and weight loss. As social support has previously demonstrated a positive correlation with weight loss (Kalodner & DeLucia, 1990) and is thought to contribute to better weight loss outcomes and maintenance (Wing & Jeffery, 1999), it was hypothesized that social support before and during the intervention would predict weight, BMI, and waist circumference at post-treatment.

Hypothesis 4: Community versus worksite treatment outcomes. For exploratory purposes, outcomes from the community Lifestyle Balance Program (Latner et al., 2013) and the worksite HMSA Lifestyle Program were compared. As few studies have evaluated the impact of setting on the effectiveness of behavioral weight loss treatment, no specific hypotheses were generated.

CHAPTER 2. METHODS

Participants

Participants were 36 overweight or obese (BMI ≥25 kg/m^2) men and women between the ages of 18-75 recruited from the employee population of the Hawaii Medical Services Association (HMSA). HMSA employs approximately 1,160 individuals at their main office building, the HMSA Center, located in the Kaka'ako business district in Honolulu, Hawaii. HMSA employees perform a range of professional, managerial, or administrative work (i.e., white-collar work).

Participants were excluded from the study if they were currently enrolled in another weight management program, reported a physical illness or condition that contraindicated moderate physical activity (e.g., congestive heart failure), reported taking dose-stable medications that may affect weight for less than two months (e.g., Metformin), reported currently taking medications for the purpose of weight loss (e.g., phentermine, orlistat), reported a current or past several psychiatric disorder, or female participants who were pregnant or breastfeeding in the past year. Additionally, prospective participants were excluded if they reported that they were planning to move, get pregnant, or leave their positions at HMSA within the following two years. These criteria were included to allow for future follow-up studies in a two-year time period.

Procedure

Recruitment. Recruitment was conducted from in early 2015 at the HMSA Center using emails sent via the HMSA employee listserv, as well as flyers and posters posted throughout the building. Prospective participants were asked to contact the study email and to include a phone number where they might be reached. Initial phone screenings were conducted to determine eligibility. Participants then attended in-person informational meetings where they were able to

ask questions about the study and received more detailed information about participation. At the end of the information meeting, eligible participants received and signed informed consent forms and provided information about their availability to participate in weekly groups.

Treatment. Participants received the Lifestyle Balance Program (Latner et al., 2013), a 20-session behavioral weight loss treatment modeled on the content of the Diabetes Prevention Program (DPP; Diabetes Prevention Program Research Group, 2002). The Lifestyle Balance Program retained all key elements of the DPP treatment (i.e., moderately reduced-calorie diet, increased physical activity, behavioral strategies to facilitated adherence to diet and activity recommendations; Jensen et al., 2014) and focused on lifestyle change to improve dietary choices and increase physical activity. Latner and colleagues (2013) tailored specific elements of the program for administration to populations residing in Hawaii. These modifications included handouts outlining the caloric content of foods commonly eaten in Hawaii (e.g., meat jun, squid, guinataan) and the use of metaphors salient to participants in Hawaii (e.g., using a surfing metaphor to discuss resuming healthy eating habits after an instance of overeating).

Two Master's-level graduate students led each HMSA-LBP group (See Group Leaders section). Each group met once a week after work hours and sessions were approximately two hours long. Group times were set based on group leaders' schedules and participant availability.

Each session began with a weigh-in during the first 5 to 10 minutes of session, a review of homework from the previous week, and the introduction of a new topic. At each meeting participants received handouts that outlined psychoeducation and discussion points for the session as well as a homework assignment. Examples of homework assignments included self-monitoring of caloric intake, setting and tracking physical activity goals, and problem solving goals. After covering new materials, group leaders facilitated a general discussion to address

participant questions and problem solve challenges from the week. Sessions then concluded with each participant being asked to say something positive about their lifestyle changes or progress. The specific topics covered in each session are as follows:

- Session 1: Welcome & Discussion of Treatment and Expectations
    - Meet leader & group members
    - Discuss treatment goals, rationale
    - Discuss benefits of weight loss
    - Discuss expectations of group
- Session 2: Getting Started Losing Weight
    - Introduce self-monitoring (including principles and instructions)
    - Assign self-monitoring and practice
- Session 3: Be a Fat Detective
    - Learn to graph weight
    - Introduce self-monitoring of weight
    - Learn basic principles and reasons for self-monitoring weight
    - Discuss fat gram goal
    - Practice finding foods in fat counter and figuring out fat grams in foods
    - Learn to calculate running total of fat grams for the day
- Session 4: Three Ways to Eat Less Fat
    - Review self-monitoring skills
    - Learn three ways to eat less fat
    - Make a plan to eat less fat
- Session 5: Healthy Eating
    - Discuss how eating less fat fits into overall healthy eating
    - Review Food Guide Pyramid
    - Compare participants eating patterns to Food Guide Pyramid
    - Review more examples of ways to eat lower fat foods
    - Introduce importance of eating more grains, fruits, and vegetables
- Session 6: Tip the Calorie Balance
    - Discuss how healthy eating and being active are related in terms of calorie balance
    - Discuss how calorie balance relates to weight loss
    - Review participants' progress so far in terms of changes made to fat/calorie intake and activity, and weight change
    - If participants are not losing as much weight as is desired, make plan for upcoming week to self-monitor calories or follow low-calorie meal plan
- Session 7: Getting Started Being Active
    - Introduce self-monitoring of activity
    - Set initial physical activity goal for the next week
- Session 8: Move Those Muscles
    - Discuss why physical activity is important
    - Discuss current level of physical activity
    - Identify types of physical activity participants may enjoy

    - Set new physical activity goals (and specific plan if necessary)
- Session 9: Being Active: A Way of Life
    - Begin to learn to graph physical activity
    - Discuss time as a barrier to activity
    - Learn different ways to find time to be active
    - Discuss lifestyle activity
    - Discuss ways to prevent injury and do simple stretches
    - Set new physical activity goals (and specific plan if necessary)
- Session 10: Take Charge of What's Around You
    - Learn about food and activity cues and ways to change them
    - Mentally search participants' homes, work places, grocery stores – look for problem food cues and ways to change them
    - Learn ways to add positive cues for activity and get rid of cues for inactivity
    - Develop activity plan for coming week
- Session 11: Problem Solving
    - Learn the five steps to problem solving
    - Practice using the steps using problems participants are experiencing now with eating less fat/calories or being more active
- Session 12: Four Keys to Healthy Eating Out
    - Learn four basic principles for healthy eating out: planning ahead, assertion, stimulus control, and healthy food choices
    - Identify specific examples of how to apply these principles at favorite restaurants
    - Practice making a meal selection from an appropriate menu
    - Practice out loud how to ask for menu substitutions
- Session 13: Talk Back to Negative Thoughts
    - Recognize that everyone has negative thoughts and identify examples
    - Learn how to stop negative thoughts and talk back to them with positive ones
    - Practice stopping negative thoughts and talking back to them with positive ones
- Session 14: The Slippery Slope of Lifestyle Change
    - Review participants' progress
    - Identify some things that cause participants to slip from healthy eating or being active
    - Discuss what to do after a slip to get "back on your feet again"
- Session 15: Jump Start Your Activity Plan
    - Discuss ways to add interest and variety to activity plans
    - Learn the definition of aerobic fitness
    - Learn the F.I.T.T. Principles (Frequency, Intensity, Time, and Type of activity) as related to heart (aerobic) fitness
- Session 16: Make Social Cues Work for You
    - Review examples of problem social cues and helpful social cues
    - Discuss ways to change problem social cues and add helpful ones
    - Review strategies for coping with social events such as parties, vacations, having visitors, and holidays
    - Make an action plan to change a problem social cue and add a helpful one
- Session 17: You Can Manage Stress
    - Discuss how to prevent stress and cope with unavoidable stress

    - Discuss how this study can be a source of stress and how to manage that stress
- Session 18: Health News – Fact or Fad?
    - Discuss how to evaluate health news
    - Discuss how to determine if a diet is balanced and healthy
    - Review resources for reliable news about health, nutrition, and physical activity
- Session 19: Ways to Stay Motivated
    - Discuss the importance of motivation and ways to stay motivated
    - Create an action plan for staying motivated
- Session 20: Preventing Weight Regain
    - Review participants' progress since first session, and if people aren't at goal weight, develop a plan to continue to improve
    - Discuss potential future challenges such as weight plateaus, challenging times, and binge eating
    - Deliver a packet of maintenance materials to participants.

Group leaders

The primary investigator co-led all three treatment groups with one of two other Master's-level clinical psychology graduate students. All three group leaders had experience running psychological intervention groups and working with patients with concerns related to eating and weight. The group leaders were provided Lifestyle Balance Treatment manuals in addition to copies of all participant handouts. Training included a review of all the materials and group leaders prepared for each session by listening to de-identified recordings of the community-based Lifestyle Balance Program (Latner et al., 2013). Before and after each session, group leaders discussed session materials and provided each other with feedback and peer supervision.

Adherence to Treatment Manual

Treatment sessions were audio recorded and reviewed by independent blind coders for therapist adherence. Coders reviewed the first three sessions of each group in addition to three additional sessions selected at random from each group. Two coders reviewed each session and a third coder resolved discrepancies between adherence ratings, with a resulting overall inter-rater agreement of kappa = 1. Coders rated sessions for adherence using checklists of all required

treatment elements for each session. Evaluations ranged from 90% adherence to 100% adherence, with a mean adherence of 96.83% across session.

Assessment of Outcome

Assessment timeline. Table 3 displays variables measured and the assessment timeline for this study. Consistent with common procedure in the weight management field (e.g., Gardner et al., 2007; Grilo, Masheb, Wilson, Gueorguieva, & White, 2011; Latner et al., 2013), participants completed full assessments of anthropomorphic, physiological, psychological, and behavioral outcomes at baseline and post-treatment (Sessions 1 and 20, respectively). Participant weight was collected at each session. Additionally, participants completed a partial assessment every fourth session. This partial assessment included weight and waist circumference, in addition to the 18-item Food Frequency Questionnaire and the 7-item International Physical Activity Questionnaire, Short-form.

Table 3
Outcome measures and assessment schedule

Variable	Measure	Session 1	Session 4	Session 8	Session 12	Session 16	Session 20
Obesity Status							
Height	Stadiometer	X					
Weight (for BMI)	Scale	X	X	X	X	X	X
Waist Circumference	Tape Measure	X	X	X	X	X	X
Physiological measures							
Plasma triglycerides	Fasting blood draw	X					X
Cholesterol (HDL & LDL)	Fasting blood draw	X					X
Fasting glucose	Fasting blood draw	X					X
Blood Pressure	Blood Pressure Cuff	X					X
Psychological & Behavioral Measures							
Eating habits	Food Frequency Questionnaire	X	X	X	X	X	X
Physical Activity Patterns	International Physical Activity Questionnaire	X	X	X	X	X	X
Body Image	Body Shape Questionnaire	X					X
Health-related Quality of Life	Impact of Weight on Quality of Life	X					X
Social Support for Weight Management	Weight Management Support Inventory	X					X
Treatment Satisfaction	Short questionnaire						X

Measures

Demographics. At baseline, information about age, gender, ethnicity, and education were collected from all participants.

Anthropomorphic measurements. Weight, height, and waist circumference was collected from all participants. Anthropomorphic measures of height, weight, and waist circumference were collected using a protocols modeled from those outlined in the National Health and Nutrition Examination Survey (NHANES) Anthropometry Procedures Manual and the NHANES Physical Examination Procedures Manual (Centers for Disease Control [CDC], 2011a, 2011b). These protocols are as follows:

Standing height. A manual stadiometer was used to measure height. Participants were directed to the stadiometer platform and asked to remove shoes from feet and any hair ornaments, jewelry, buns, or braids from the top of the head. Then participants were asked to stand up straight against the stadiometer backboard with weight evenly distributed and their feet flat on the stadiometer platform at an approximately 60-degree angle with their heels together and toes apart. Measurements were taken with the back of each participant's head, shoulder blades, buttocks, and heels touching the backboard. Some participants' body conformation did not allow touching of all four points—if this is the case, measurements were taken with the participants' trunk vertically above the waist with arms and shoulders relaxed. During measurement, each participant's head was aligned such that the horizontal line from the ear canal to the lower border of the orbit of the eye is parallel to the floor and perpendicular to the vertical backboard. When the body and head were correctly aligned, the stadiometer headpiece was placed to rest firmly on the participant's head, gently compressing hair. Participants were instructed to take a deep breath and hold the position while measurement was taken.

Weight. Participants were weighed while wearing light clothing (i.e. removing heavy jackets, belt buckles, etc.) using a digital Tanita SC-331S scale. Participants removed shoes and socks for weighing and stood in the center of the scale platform with their weight evenly distributed. Participants were measured facing forward with hands at their sides and looking straight ahead.

Waist circumference. To measure waist circumference, participants were asked to cross their arms, placing their hands on opposite shoulders. With the participant's consent, the examiner then identified the participant's right and left iliac crest. A waist circumference measuring tape was then extended around the waist such that it was horizontally aligned with the right and left iliac crests. Measurements were taken with the measuring tape parallel to the floor and snug without compressing the skin. Measurements were taken to the nearest 0.1 cm at the end of the participant's normal expiration.

Physiological measurements. Blood pressure, plasma triglycerides, cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), blood glucose, and Hemoglobin A1c (HbA1c) were assessed for all participants at baseline and post-treatment. Physiological measures will be derived from blood work conducted after a 10-hour fast and analyzed using standardized protocols by a local laboratory service.

Blood pressure. The protocol for blood pressure assessment was as follows: participants were asked ahead of time to try to wear clothing that permits for bare measurement of the arm (i.e. sleeves that can be removed or rolled up). Blood pressure was measured with an electronic blood pressure machine using the right arm with the participant in a sitting position. One participant reported that a past condition prohibited the use of her right arm, so measurements were taken from her left arm. All participants were asked to sit all the way to the back of a chair

such that their spine was straight with his/her arms and back supported. Measurements were taken with participants' legs uncrossed with both feet flat on the floor and their right arm positioned such that the palm of the hand was turned upward and the elbow slightly flexed. The measurement arm was positioned such that the midpoint of the upper arm was relatively level with the heart (i.e. junction of the fourth intercostal space and lower left sternal border). The blood pressure cuff was fitted at least 1 inch above the crease of the elbow with the marked center of the cuff placed directly over the brachial artery. Group leaders were instructed on how to palpate and locate the brachial pulse for this purpose. The cuff was fitted such that it fit smoothly and snuggly on the participant with no more than two fingers able to fit under the cuff. Once the cuff was fitted, the participant was asked to sit quietly for one minute. After one minute, the group leader started the blood pressure machine and noted the output measurements.

Psychological and behavioral measurements. Psychological and behavioral outcomes were measured using a battery of self-report questionnaires.

Eating habits. The Food Frequency Questionnaire (FFQ; Kristal, Beresford, & Lazovich, 1994; Kristal, Shattuck, & Henry, 1990; Kristal et al., 1992) is an 18-item questionnaire that consists of five subscales that assess consumption patterns of meat, fats, vegetables, and modifications or substitutions of dietary fat over the past month. In addition, the scale yields a total score. Items are rated on a 4-point Likert scale from 1 = *always* to 4 = *never*, such that lower scores indicate better food choices. The authors of the scale demonstrated its adequate basic psychometric properties in three studies noting good convergent validity with another established food recording system known as 4-d Diet Records as well as good test-retest reliability (Kristal et al., 1994). In the present sample, the Food Frequency questionnaire

demonstrated questionable to acceptable internal consistency with Cronbach's alphas ranging from .62 to .75.

Physical activity. The International Physical Activity Questionnaire, Short-form (IPAQ; Craig et al., 2003) is an instrument that measures participants' levels of activity in the week prior to assessment (e.g., During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?). The short form of the IPAQ is a six-item measure that is comprised three domains of physical activity: vigorous, moderate, and walking. Physical activity and inactivity for each domain is measured in minutes per week. The authors of the IPAQ have established evidence for its reliability and criterion validity in samples in at least twelve countries (Craig et al., 2003).

Weight-related quality of life. The Impact of Weight on Quality of Life-Lite Scale (IWQOL; Kolotkin, Crosby, Kosloski & Williams, 2001; Kolotkin & Crosby, 2002) is an obesity-specific measure that assesses weight-related impairment on quality of life across 5 domains: physical function, self-esteem, sexual life, public distress, and work. Items are rated on a 5-point Likert scale from 1= *never true* to 5 = *always true*, such that lower scores indicate greater quality of life impairment. This developers of the shortened measure demonstrated its acceptable reliability in both clinical and community samples with Cronbach's alphas ranging from .81 to .94 on its respective subscales as well as strong evidence for the scale's convergent and discriminant validity in overweight and obese subjects (Kolotkin et al., 2001; Kolotkin & Crosby, 2002). In the present study, the IWQOL subscales demonstrated acceptable to excellent internal consistency with Cronbach's alphas ranging from .72 to .92.

Body image. The 14-item version of the Body Shape Questionnaire (BSQ; Cooper, Taylor, Cooper, & Fairburn, 1987; Dowson & Henderson, 2001) is a measure of body

dissatisfaction. Items are rated on a 6-point Likert scale ranging from 1 = *never* to 6 = *always* with higher scores indicating greater body dissatisfaction. The authors of the BSQ have demonstrated its good internal consistency with Cronbach's alpha of 0.93 and convergent validity with other measures assessing body image (Cooper et al., 1987). In the present sample, the BSQ demonstrated excellent internal consistency with Cronbach's alphas of .95 and .92 at baseline and post-treatment, respectively.

Social support. The Weight Management Support Inventory (WSMI; Rieder & Ruderman, 2007) is a 26-item measure of support perceived by individuals attempting to manage their weight. The WMSI consists of items asking respondents how frequently they experienced a certain interaction in the last four weeks, ranging from 1 = *never* to 5 = *daily*. Items also ask how helpful an even was ranging from 1 = *not helpful* and 5 = *extremely helpful.* The WSMI yields a total score as well as an overall score for frequency and an overall score for helpfulness. Higher scores on the WSMI indicate more frequent or helpful social support events. The developers of the WSMI have established its good convergent validity with other measures of general support as well as its acceptable internal consistency with Cronbach's alphas ranging from .85 to .91 (Rieder & Ruderman, 2007). In this sample, the WMSI's subscales demonstrated adequate to excellent internal consistency with Cronbach's alphas ranging from .79 to .90.

Treatment satisfaction. At post-treatment, treatment satisfaction was assessed by asking participants to rate general satisfaction with the Lifestyle Balance Program, satisfaction dietary or physical activity changes made, and satisfaction with weight lost or maintained. Answers were ranked on a 5-point scale ranging from 1 = *very satisfied* to 5 = *very dissatisfied.*

CHAPTER 3. STATISTICAL ANALYSES

Power Calculation

In order to calculate adequate power for the proposed repeated measures analysis of variance, a power calculations was conducted using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007) based on a one-way repeated measures multiple analysis of variance (MANOVA) with two measurements with an alpha set at .05. According to Cohen (1992), effect sizes for small, medium, and large effects for analyses of variance are .10, .25, and .40, respectively. As previous behavioral weight loss research reported moderate effect sizes on reduction of weight in controlled studies (e.g., Latner et al., 2013; Gardner et al., 2007; Grilo et al., 2011), a medium effect size of .25 was selected. A total sample of 34 was determined necessary to achieve a power of .80. Given the high attrition rates reported by past behavioral weight loss studies, the goal for recruitment was at least 49 participants to allow for 30% attrition.

Data Preparation

Research assistants double entered all data and discrepancies were reconciled in order to minimize any human errors in data entry. The ranges of all measures were examined to see if any impossible outliers existed within the data. One participant's weight was identified as an outlier. However, analyses conducted with and without this data yielded similar results so this data was retained for all analyses. The data were then evaluated for missing data. Missing value analysis was used to examine if other missing data occurred at random or systematically and it was determined that missing values occurred completely at random. Analyses were conducted on a pairwise basis to account for those participants who completed each time point but who were missing specific variables.

As some participant attrition was anticipated, analyses for pre- and post-treatment weight outcomes, physiological, behavioral and psychological measures were conducted on an intent-to-treat (ITT) basis for participants with missing data at post-treatment. This conservative method has been used by previous weight loss trials to address missing assessment data (e.g., Latner et al., 2013; Gardner et al., 2007; Grilo et al., 2011). For repeated measures, analyses were conducted on a last observation carried forward basis for participants with missing data points throughout treatment. Analyses were also conducted using mean substitution and regression substitution to replace missing values, but the overall pattern of results did not differ between these methods so last-observation-carried-forward results are presented here. In addition to ITT analyses, analyses were also conducted for completers only.

Preliminary Analyses

Baseline means, and standard deviations were calculated for demographic variables (age, BMI). Baseline differences in demographic variables and physiological, behavioral and psychological measures between the three treatment groups were examined using one-way analysis of variance (ANOVA), and no significant differences were found between the three groups.

Means and standard deviations for the dependent variables were calculated at each assessment time point. Pearson's product-moment correlations were conducted to assess the interrelatedness of outcome measures at pre- and post-treatment. The data were then assessed for violations of the assumptions necessary for parametric testing. The distribution of dependent variables was then assessed for outliers using boxplots and assessed for normality by the Shapiro-Wilk's test. In cases where data had outliers and/or non-normal distribution (Shapiro-Wilk's $p>.05$), the data were mathematically transformed to meet the assumption of normality.

However, as the overall pattern of results did not differ between transformed and non-transformed data, results from the original data are presented here.

Analyses

Hypothesis 1: Treatment adherence, completion, and satisfaction. To examine treatment adherence, the mean number of sessions participants attended was calculated, and the proportion of participants who adhered to treatment (defined as those who attended at least 15 of 20 sessions) was computed. Baseline differences between participants who adhered to treatment and those who did not were assessed with independent-samples t-tests for continuous baseline measures (age, BMI, anthropomorphic measurements, physiological, behavioral and psychological measures) and χ^2 tests for categorical baseline measures (gender, ethnic identification, educational attainment).

Additionally, the percentage of participants who completed treatment (operationalized as those who attended session 19 and/or session 20) was computed. Baseline differences between treatment completers and non-completers were assessed one-way ANOVA for continuous baseline measures (age, BMI, anthropomorphic measurements, physiological, behavioral and psychological measures) and χ^2 tests for categorical baseline measures (gender, ethnic identification, educational attainment).

To assess treatment satisfaction, means and standard deviations were computed for each of the items from the treatment satisfaction survey.

Hypothesis 2: Treatment outcomes. To test Hypothesis 2, the percentage of participants achieving a clinically meaningful weight loss of 5% or more was calculated. Similarly, the percentage of participants who achieved a weight loss of 3% or greater and those who lost less than 3% was calculated. Baseline differences between participants achieving

clinically significant weight loss and those who did not were assessed with independent-samples t-tests for continuous measures (age, BMI, anthropomorphic measurements, physiological, behavioral and psychological measures) and χ^2 tests for categorical measures (gender, ethnic identification, educational attainment)

Two repeated measures multivariate analysis of variance were conducted to assess changes from pre-treatment to post-treatment in anthropomorphic, physiological, behavioral and psychological outcomes. The first repeated measures MANOVA was conducted to determine the effect of the intervention on weight, waist circumference, systolic and diastolic blood pressure plasma triglycerides, total cholesterol, and fasting glucose, overall eating habits, total exercise, body image, overall health-related quality of life, and overall social support for weight management. Subsequent paired samples *t*-tests were then conducted to assess mean changes from pre-treatment to post-treatment in all dependent variables. As some participant attrition occurred, analyses were conducted on an intent-to-treat basis for participants with missing data at post-treatment using baseline data carried forward. This conservative imputation approach is consistent with the methods used by previous weight loss trials to address missing assessment data (e.g., Latner et al., 2013; Gardner et al., 2007; Grilo, Masheb, Wilson, Gueorguieva, & White, 2011). In addition to ITT analyses, information on completers was also analyzed.

Additionally, to examine what changes may have occurred over time and whether changes were sustained for the duration of treatment, a repeated measures MANOVA with six within-subject levels (baseline, session 4, 8, 12, 16, and 20) was conducted to assess intervention effects on weight, body mass index, waist circumference, total eating habits and total physical activity. Subsequent univariate repeated measures ANOVA analyses and pairwise post hoc comparisons with Bonferroni's adjustment were conducted for each variable. In cases where the

assumption of sphericity was violated, a Greenhouse-Geisser correction was applied. For these analyses, rather than utilizing baseline-carried-forward ITT analyses, missing data was addressed using end-point carried forward ITT analyses to allow for examination of differences across sessions.

Hypothesis 3: Social support. As it was anticipated that changes in social support would be associated with improvements in weight-related outcomes, multiple regression analyses were conducted controlling for baseline social support and the respective baseline weight, BMI, or waist circumference to determine if change in frequency and helpfulness of social support predicted post-treatment weight, BMI, or waist circumference.

Hypothesis 4: Community versus worksite treatment outcomes. To explore potential differences between Lifestyle Balance outcomes when the intervention was delivered in community settings versus worksite settings, outcome data previously collected at community organizations (Latner et al., 2013) and HMSA-LBP outcome data were compared. Baseline differences between study groups were examined using one-way ANOVAs and Pearson's χ^2 analyses for continuous and categorical data, respectively.

To examine differences in treatment adherence and completion, the mean number of sessions community participants attended was calculated and differences in the attendance of community participants versus worksite participants were assessed with independent-sample t-tests. The proportion of community participants who adhered to treatment (defined as those who attended at least 15 of 20 sessions) and completed treatment (operationalized as those who attended session 19 and/or session 20) was computed. Differences in the proportion of adherents and completers among community participants and worksite participants were examined using Pearson's χ^2 analyses.

To examine the main effects of setting and across time as well as their hypothesized interaction, 2 x 2 mixed ANOVA one within-subject factor (time: baseline and post treatment) and one between-subject factor (group setting: community and worksite) were conducted on dependent variables. In cases where time x setting interaction were found, separate repeated measure ANOVAs were conducted for each setting, and one-way ANOVA were conducted to examine the group setting effect at each time point.

CHAPTER 4. RESULTS

Participants

The flow of participants is shown in Figure 1. Fifty-nine individuals were screened, and 48 were eligible to participate. Eleven individuals were screened out because they met one or more of the exclusion criteria, and twelve individuals elected not to participate or could not participate. Participants included in the study did not differ from those who did not participate with respect to age, gender, or BMI. The remaining 36 participants elected to participate and were allocated to one of three treatment groups. Group sizes ranged from 11 to 14 participants. One-way ANOVAs revealed that there were no significant differences between the three treatment groups on baseline age, BMI, anthropomorphic measurements, or physiological, behavioral or psychological measures. χ^2 analyses demonstrated no significant differences between the three treatment groups on gender, ethnic identification, or educational attainment.

Table 4
Demographic Characteristics of Participants (n = 36)

Characteristic	n	%
Gender		
Female	26	72.2
Male	10	27.7
Sexual Orientation		
Heterosexual	32	88.8
Non-heterosexual	4	11.2
Body Mass Index		
Overweight (25.0 $kg/m^2 \leq$ BMI < 30.0 kg/m^2)	10	27.8
Obese (BMI $\geq$ 30.0 kg/m^2).	26	72.2
Ethnicity		
Asian	17	47.2
Caucasian	6	16.7
Mixed Ethnicity	13	36.1
Highest education level achieved		
High school diploma	2	5.6
Associate's degree	9	25.0
Bachelor's degree	17	47.2
Advanced degree	5	13.9

Figure 1. Participant Flow

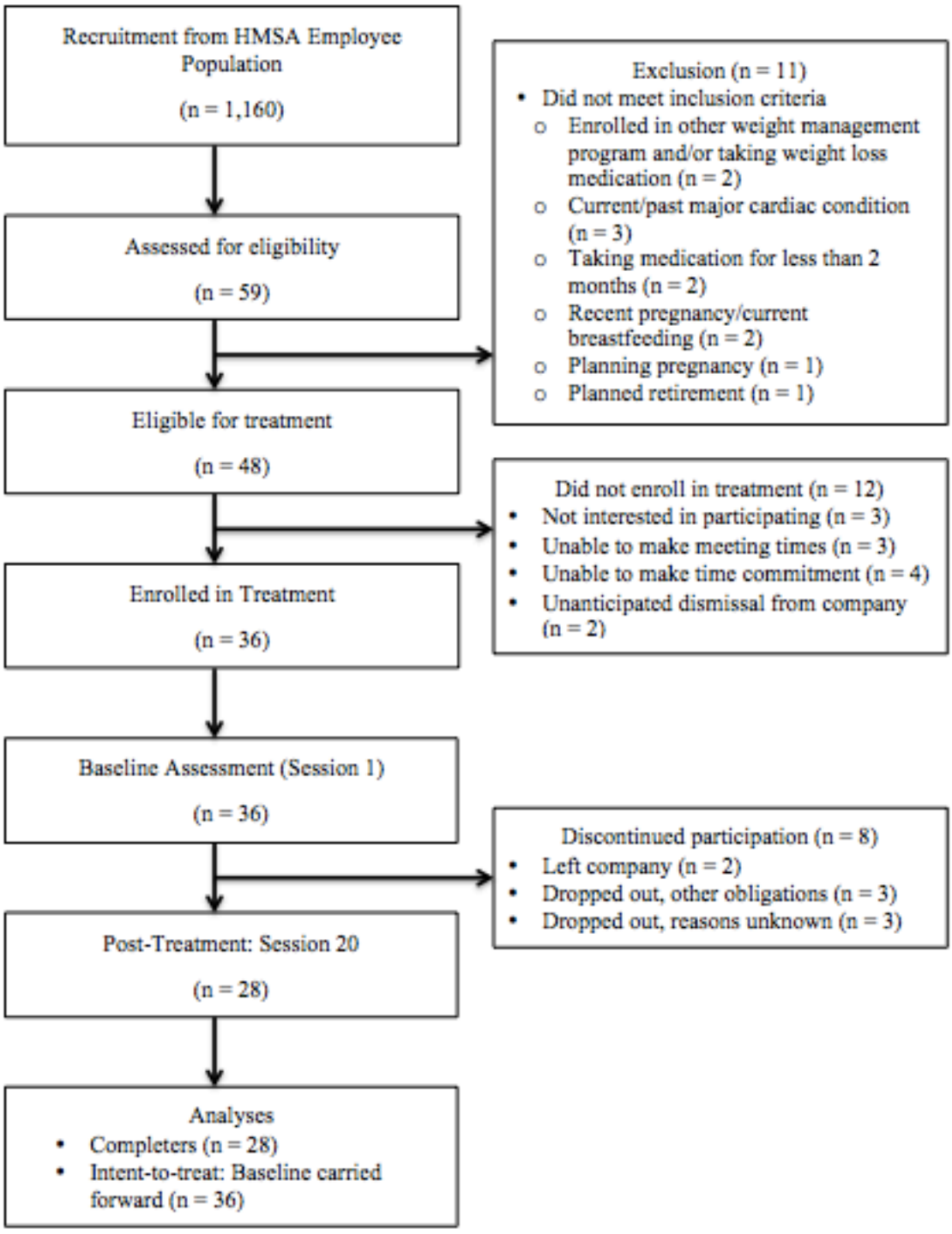


Table 4 displays demographic information for participants. At baseline, the thirty-six enrolled participants had a mean age of 48.67 (*SD* = 10.50) years. Participants' mean baseline weight was 96.70 kg (*SD* = 26.86) and mean BMI was 35.75 kg/m^2 (*SD* = 7.11).

Interrelatedness of Outcome Measures

Table 5 displays correlations between physiological outcome measures at pre-treatment and post-treatment. As expected, significant correlations were observed between weight, BMI, and waist circumference at both pre- and post-treatment. Additional significant correlations were observed between several physiological outcomes, including total cholesterol and LDL cholesterol, total cholesterol and fasting glucose, fasting glucose and hemoglobin A1c, and systolic and diastolic blood pressure. At pre-treatment, significant correlations were observed between LDL cholesterol and fasting glucose as well as between LDL and hemoglobin A1c. At post-treatment, a significant correlation was observed between total cholesterol and HDL cholesterol.

Table 6 displays correlations between total behavioral and psychological outcome measures at pre-treatment and post-treatment. At both pre- and post-treatment, significant correlations were observed between BMI and weight-related quality of life as well as between and social support frequency and social support helpfulness. Significant correlations between weight-related quality of life and eating habits, and weight-related quality of life and body image were observed at pre-treatment, but not post-treatment.

Treatment Adherence, Completion, and Satisfaction

Treatment adherence. Participants attended a mean of 14.25 (*SD* = 5.39) of 20 sessions. Twenty-two (61.1%) of 36 participants adhered to treatment, operationally defined as having attended 15 or more sessions. Adherent participants attended a mean of 17.72 sessions (*SD* =

Table 5

Pearson's product-moment correlations for pre- and post-treatment physiological outcomes.

	Weight	BMI	Waist Circum-ference	Plasma tri-glycerides	Total cholesterol	HDL cholesterol	LDL cholesterol	Fasting glucose	Hemoglobin A1c	Systolic blood pressure	Diastolic blood pressure
Weight		.851**	.895**	.202	-.004	-.458*	.137	.332	.114	.124	.059
BMI	.915**		.789**	.227	-.015	-.352	.035	.254	.075	.133	.249
Waist circumference	.933**	.859**		.259	.057	-.368	.123	.282	.115	-.010	0.28
Plasma triglycerides	-.111	-.137	0.041		.168	-.416*	-.166	-.130	-.163	.147	.054
Total cholesterol	.253	.230	.334	.163		.429*	.911**	.023	-.096	-.210	-.250
HDL cholesterol	-.430	-.314	-.334	-.546**	.254		.217	.061	.037	-.232	-.105
LDL cholesterol	-.069	-.139	-.090	-.142	.890**	.133		.071	-.051	-.218	-.276
Fasting glucose	.184	.259	.259	.150	-.446*	-.152	-.505**		.801**	.177	.096
Hemoglobin A1c	.003	-.044	.111	.206	-.462	-.220	-.523**	.887**		.150	.109
Systolic blood pressure	.322	.223	.344	.135	.275	.012	.212	-.026	-.082		.816**
Diastolic blood pressure	.338	386	.332	.147	.202	-.148	.199	-.077	-.215	.655**	

PRE-TREATMENT

POST-TREATMENT

Note. Post treatment outcomes are indicated as shaded area.

*Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.05 level (2-tailed)

Table 6

Pearson's product-moment for pre- and post-treatment behavioral and psychological outcomes.

	Weight	BMI	Waist Circum-ference	Eating habits total	Physical Activity Patterns	Weight-related quality of life	Body image	Social support frequency	Social support helpfulness
Weight		.851**	.895**	.024	-.040	.202	.178	-.006	.041
BMI	.915**		.789**	.307	.043	.552**	.059	-.123	.089
Waist circumference	.933**	.859**		-.177	.088	.121	-.048	-.131	-.020
Eating habits total	.255	.340	.128		-.344	.371	.135	-.468	-.242
Physical Activity Patterns	.094	.011	.032	-.340		.123	.183	.019	-.275
Weight-related quality of life	.257	.549**	.237	.487**	0.151		.182	.135	-.244
Body Image	-.113	.072	-.130	.052	-.109	.452*		.258	.453
Social support frequency	.087	.076	.046	-.215	.331	.137	.388		.502*
Social support helpfulness	.246	.245	.116	.162	**.264**	.156	.353	.721**	

PRE-TREATMENT — **POST-TREATMENT**

Note. Post treatment outcomes are indicated as shaded area.

*Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.05 level (2-tailed)

1.51) and non-adherent participants attended a mean of 8.78 sessions (*SD* = 4.69). Table 7 present means, standard deviations, and independent samples t-test results comparing baseline measures for adherent and non-adherent participants. Adherent participants did not significantly differ from non-adherent participants on baseline weight, BMI, physiological measurements, eating habits, and physical activity. However, on average, adherent participants were significantly older than non-adherent participants. At baseline, adherent participants reported better work and overall health-related quality of life and better body satisfaction compared to non-adherent participants. However, at baseline adherent participants reported that they received less frequent support for weight management as well as less helpful support compared to non-adherent participants. χ^2 tests revealed no associations between treatment adherent status and treatment group $\chi^2(2) = 0.53$, $p = .766$, gender, $\chi^2(1)$ 1.83, $p = .176$, sexual orientation, $\chi^2(1) = 1.53$, $p = .216$, ethnicity, $\chi^2(2) = 2.05$, $p = .358$, and educational attainment, $\chi^2(3) = 0.118$, $p = .731$.

Treatment completion. Of the 36 participants who enrolled in treatment, 28 (77.78%) participants completed treatment (operationally defined as having attended session 19 or 20). Completers attended a mean of 16.75 sessions (*SD* = 2.36) and non-completers attended a mean of 5.5 sessions (*SD* = 3.38). Table 8 present means, standard deviations, and independent samples t-test results comparing baseline measures for participants who completed treatment and participants who did not complete treatment. At baseline, treatment completers did not significantly differ from non-completers on weight, BMI, anthropomorphic or physiological measurements, and behavioral or psychological measurements. On average, completers were significantly older than non-completers. χ^2 tests revealed no associations between completer status and treatment group $\chi^2(2) = 1.02$, $p = .599$, gender, $\chi^2(1) = .287$, $p = .592$, sexual

Table 7

Group differences between adherent (n = 22) and non-adherent (n = 14) participants.

	Adherent		Non-Adhe ent					
	M	*SD*	*M*	*SD*	*df*	*t*	*p*	*Cohen's d*
Age	52.50	8.79	42.64	10.40	34	-3.05	**.004**	-1.03
Weight Status								
Weight (kg)	92.62	22.70	105.67	34.70	34	1.15	.259	0.39
BMI (kg/m^2)	34.72	6.01	37.38	8.56	34	1.10	.281	0.38
Waist circumference (cm)	106.68	13.15	114.09	24.79	32	1.15	.260	0.41
Physiological measures								
Plasma triglycerides	156.38	88.23	124.78	32.13	28	-1.04	.309	-0.39
Total cholesterol	178.71	30.55	183.44	28.33	28	0.40	.695	0.15
HDL cholesterol	51.24	13.83	48.33	8.37	28	-0.58	.565	-0.22
LDL cholesterol	96.10	28.10	110.11	21.78	28	1.33	.194	0.50
Fasting glucose	109.14	19.57	101.78	8.94	28	-1.07	.292	-0.40
Hemoglobin A1c	6.14	0.95	5.86	0.42	28	-0.86	.395	-0.33
Systolic blood pressure	133.27	14.29	138.50	26.57	32	0.75	.458	0.27
Diastolic blood pressure	88.41	10.64	91.83	13.64	32	0.81	.423	0.29
Behavioral & Psychological Measures								
Eating habits*								
Meat	2.72	0.41	2.88	0.60	31	0.86	.393	0.31
Fat	2.70	0.36	2.79	0.51	33	0.60	.547	0.21
Vegetables	3.02	0.73	3.17	0.69	32	0.56	.579	0.20
Modifications/substitutions	3.25	0.50	3.10	0.47	32	-0.89	.378	-0.31
Total	2.95	0.38	2.98	0.49	32	0.21	.834	0.07
Physical Activity Patterns**								
Vigorous	35.68	85.44	30.00	58.62	32	-0.25	.839	-0.09
Moderate	47.50	78.86	60.00	122.03	32	0.36	.719	0.13
Walking	165.45	122.54	88.75	120.42	32	-1.75	.089	-0.62
Total	248.64	200.20	178.75	236.61	32	-0.91	.368	-0.32
Weight-related Quality of Life*								
Physical functioning	2.12	0.87	2.42	0.68	31	0.99	.328	0.36
Self esteem	2.17	0.89	2.84	1.14	30	1.85	,074	0.68
Sexual life	1.51	0.73	1.55	0.96	30	0.12	.901	0.04
Public distress	1.24	0.43	1.64	0.94	31	1.65	.108	0.59
Work	1.36	0.58	1.57	0.77	27	0.86	.396	0.33
Total	1.74	0.59	2.26	0.69	27	2.15	**.040**	0.83
Body Image*	3.11	1.07	4.07	1.12	30	2.38	**.024**	0.87
Social Support for Weight Management**								
Frequency	1.48	0.45	2.08	0.43	25	3.17	**.004**	1.27
Helpful	1.80	0.63	2.57	0.62	21	2.82	**.010**	1.23

*Lower scores indicate better eating habits, weight-related quality of life, and body image

**Higher scores indicate more time spend in physical activity, and more frequent or helpful social support

Table 8
Group differences between completers (n = 28) and non-completers (n = 8)

	Completers		Non-Completers					
	M	*SD*	*M*	*SD*	*df*	*t*	*p*	*Cohen's d*
Age	50.71	9.40	41.50	11.61	34	-2.32	**.026**	-0.80
Weight Status								
Weight (kg)	91.97	21.31	117.73	40.60	34	2.06	.050	0.71
BMI (kg/m^2)	34.56	5.90	39.94	9.63	34	1.96	.058	0.67
Waist circumference (cm)	41.93	4.93	48.17	12.87	32	2.03	.050	0.72
Physiological measures								
Plasma triglycerides	147.65	81.95	142.00	27.19	28	-0.13	.894	-0.05
Total cholesterol	180.46	29.93	178.00	30.57	28	-0.15	.880	-0.06
HDL cholesterol	51.08	13.11	45.75	3.77	28	-0.79	.432	-0.30
LDL cholesterol	99.77	27.66	103.75	23.37	28	0.27	.788	0.10
Fasting glucose	107.58	18.42	102.75	5.12	28	-0.51	.611	-0.19
Hemoglobin A1c	6.07	0.88	6.00	0.45	28	-0.14	.887	-0.05
Systolic blood pressure	134.71	18.42	137.00	24.81	32	0.26	.797	0.09
Diastolic blood pressure	90.04	11.42	87.67	13.94	32	-0.44	.660	-0.16
Behavioral & Psychological Measures								
Eating habits*								
Meat	2.77	0.44	2.83	0.71	31	0.30	.762	0.11
Fat	2.73	0.40	2.76	0.52	33	0.16	.870	0.06
Vegetables	3.02	0.74	3.33	0.52	32	0.98	.330	0.35
Modifications/substitutions	3.23	0.46	3.02	0.64	32	-0.95	.348	-0.34
Total	2.96	0.39	2.99	0.57	32	0.15	.881	0.05
Physical Activity Patterns**								
Vigorous	34.46	78.00	30.00	73.48	32	-0.12	.899	-0.04
Moderate	38.39	71.97	115.00	159.22	32	1.86	,071	0.66
Walking	146.07	117.58	102.50	166.06	32	-0.76	.449	-0.27
Total	218.93	186.48	247.50	332.41	32	0.294	.771	0.10
Weight-related Quality of Life*								
Physical functioning	2.23	0.83	2.20	0.77	31	-0.06	.946	-0.02
Self esteem	2.35	1.00	2.69	1.16	30	0.67	.505	0.24
Sexual life	1.55	0.82	1.31	0.63	30	-0.56	.577	-0.20
Public distress	1.35	0.65	1.52	0.79	30	0.52	.603	0.19
Work	1.44	0.63	1.40	0.76	31	-0.11	.906	-.04
Total	1.88	0.68	2.19	0.58	27	0.85	.400	0.33
Body Image*	3.33	1.16	4.01	1.14	30	1.21	.235	0.44
Social Support for Weight Management**								
Frequency	1.58	0.49	2.11	0.49	25	1.98	.058	0.79
Helpful	1.95	0.71	2.65	0.46	21	1.89	.072	0.82

*Lower scores indicate better eating habits, weight-related quality of life, and body image

**Higher scores indicate more time spend in physical activity, and more frequent or helpful social support

orientation, $\chi^2(1) = .201$, $p = .654$, ethnicity, $\chi^2(2) = 0.459$, $p = .795$, and educational attainment, $\chi^2(3) = 7.48$, $p = .058$. Given the small and uneven sample sizes of these analyses, these results should be interpreted with caution.

Treatment Satisfaction. Data on treatment satisfaction were only available for participants who completed treatment. On average, completers were 'very satisfied' to 'satisfied' with the HMSA Lifestyle Balance Program in general ($M = 1.28$, $SD = 0.45$). Completers also indicated that they were 'very satisfied' to 'satisfied' with the changes made in their eating ($M = 1.64$, $SD = 0.95$), 'satisfied' with the changes made in their physical activity ($M = 2.04$, $SD = 1.30$), and 'satisfied' with their weight loss or weight maintenance ($M = 2.00$, $SD = 1.29$).

Treatment Outcomes

Pre-Treatment to Post-Treatment Outcomes. ITT analyses using repeated measures MANOVA with two within-subject levels (pre-treatment and post-treatment) revealed a statistically significant main effect of time on the combined dependent variables of weight, waist circumference, systolic and diastolic blood pressure, plasma triglycerides, total cholesterol, and fasting glucose, overall eating habits, total exercise, body image, overall health-related quality of life, and overall social support for weight management, $F(12, 2) = 101.379$, $p = .010$, Wilks' $\lambda = .002$, partial $\eta^2 = .998$. Given the significance of the omnibus MANOVA, follow up paired sample t-tests for all dependent significance of the omnibus MANOVA, follow up paired sample t-tests for all dependent variables were conducted. Completer and ITT paired-sample t-test results were not significantly different.

Tables 9 and 10 present means, standard deviations, and paired samples t-test results for pre- and post-treatment weight and physiological, behavioral, and psychological outcomes for completer and ITT analyses, respectively.

Table 9

Means and standard deviations of outcome measures at pre- and post-treatment for participants (completer analyses; n = 28)

	Baseline		Post-Treatment					
	M	*SD*	*M*	*SD*	*df*	*t*	*p*	*Cohen's d*
Weight Status								
Weight (kg)	91.97	21.27	86.45	19.85	27	5.69	**<.001**	2.19
BMI (kg/m^2)	34.56	7.11	32.04	7.38	27	4.41	**<.001**	1.70
Waist Circumference (cm)	106.47	18.08	102.08	18.99	27	5.56	**<.001**	2.14
Percent weight loss (% initial weight)	0.00	0.00	5.88	4.68	27	-6.64	**<.001**	2.56
Physiological measures								
Plasma triglycerides	153.04	85.73	129.00	78.97	23	2.20	**.038**	0.92
Total Cholesterol	179.56	30.08	179.34	31.68	23	0.03	.971	0.01
HDL Cholesterol	50.26	13.73	52.04	13.90	23	-0.13	.181	0.05
LDL Cholesterol	99.18	27.80	102.00	27.35	23	-0.48	.633	0.20
Fasting glucose	107.78	19.12	100.52	14.24	23	2.21	**.038**	0.92
Hemoglobin A1c	6.08	0.93	5.79	0.46	23	1.81	.085	0.75
Systolic Blood Pressure	134.71	18.42	126.46	16.48	27	2.39	**.024**	0.92
Diastolic Blood Pressure	90.03	11.41	84.57	11.10	27	2.70	**.012**	1.04
Behavioral & Psychological Measures								
Eating habits*								
Meat	2.63	0.43	2.43	0.45	20	2.37	**.027**	1.06
Fat	2.60	0.35	2.52	0.35	22	0.66	.510	0.28
Vegetables	3.04	0.76	3.02	0.61	23	0.10	.919	0.04
Modifications/substitutions	3.21	0.48	3.06	0.45	20	1.32	.200	0.59
Total	2.85	0.39	2.80	0.29	16	0.42	.675	0.21
Physical Activity Patterns**								
Vigorous	41.19	87.66	87.60	108.16	20	-1.66	.111	0.74
Moderate	47.50	78.85	114.09	121.72	21	-2.87	**.009**	1.25
Walking	172.72	116.46	297.27	351.36	21	-1.94	.065	0.85
Total	245.78	179.12	527.89	450.82	21	-2.99	**.008**	1.30
Weight-related Quality of Life*								
Physical Functioning	2.12	0.74	1.82	0.76	23	1.89	.086	0.78
Self Esteem	2.18	0.84	1.84	0.66	24	2.60	**.016**	1.06
Sexual Life	1.46	0.76	1.46	0.96	21	0.00	1.00	0.00
Public Distress	1.24	0.61	1.22	0.47	22	0.12	.905	0.05
Work	1.30	0.52	1.14	0.36	23	1.81	.083	0.75
Total	1.70	0.57	1.47	0.48	19	2.94	**.008**	1.35
Body Image*	3.35	1.12	2.84	0.91	23	2.72	**.012**	1.13
Social Support for Weight Management**								
Frequency	1.59	0.42	1.98	0.36	18	-3.84	**<.001**	1.81
Helpful	1.79	0.51	2.71	0.80	14	-4.05	**<.001**	2.16

*Lower scores indicate better eating habits, weight-related quality of life, and body image

**Higher scores indicate more time spend in physical activity, and more frequent or helpful social support

Table 10

Means and standard deviations of outcome measures at pre- and post-treatment for all participants (intent-to-treat analyses using baseline carried forward)

	Baseline		Post-Treatment					
	M	*SD*	*M*	*SD*	*df*	*t*	*p*	*Cohen's d*
Weight Status								
Weight (kg)	97.69	28.24	92.44	26.87	35	5.07	**<.001**	1.71
BMI (kg/m^2)	36.09	7.61	34.17	7.38	35	5.51	**<.001**	1.86
Waist Circumference (cm)	109.24	18.08	105.66	18.99	33	5.09	**<.001**	1.77
Percent weight loss (% initial weight)	0.00	0.00	4.57	4.80	35	-5.70	**<.001**	1.93
Physiological measures								
Plasma triglycerides	146.90	76.62	128.47	69.99	29	2.16	**.039**	0.80
Total Cholesterol	180.13	29.49	179.97	30.74	29	0.04	.971	0.01
HDL Cholesterol	50.37	12.37	51.73	12.53	29	-1.38	.180	0.51
LDL Cholesterol	100.30	26.80	102.37	26.40	29	-0.49	.630	0.18
Fasting glucose	107.14	17.53	101.38	13.43	28	2.17	**.038**	0.82
Hemoglobin A1c	6.06	0.83	5.83	0.44	29	1.78	.085	0.66
Systolic Blood Pressure	135.11	19.27	128.32	18.22	33	2.35	**.025**	0.82
Diastolic Blood Pressure	89.61	11.70	85.11	11.47	33	2.65	**.012**	0.92
Behavioral & Psychological Measures								
Eating habits*								
Meat	2.78	0.49	2.65	0.54	32	2.29	**.029**	0.81
Fat	2.74	0.42	2.69	0.44	33	0.67	.506	0.23
Vegetables	3.07	0.71	3.06	0.60	33	1.32	.198	0.46
Modifications/substitutions	3.20	0.49	3.11	0.47	33	0.10	.918	0.04
Total	2.96	0.41	2.94	0.38	32	0.43	.668	0.15
Physical Activity Patterns**								
Vigorous	34.70	77.10	58.79	95.09	32	-1.26	.215	0.45
Moderate	51.91	94.64	95.00	122.81	33	-2.71	**.011**	0.94
Walking	138.38	125.59	218.97	308.32	33	-1.90	.066	0.66
Total	223.97	212.88	381.62	407.40	32	-2.75	**.010**	0.97
Weight-related Quality of Life*								
Physical Functioning	2.21	0.82	1.97	0.86	31	1.86	.086	0.66
Self Esteem	2.40	1.01	2.13	0.98	31	2.55	**.016**	0.92
Sexual Life	1.52	0.79	1.52	0.93	31	0.00	1.00	0.00
Public Distress	1.37	0.66	1.36	0.58	31	0.12	.904	0.04
Work	1.43	0.64	1.31	0.58	32	1.79	.083	0.63
Total	1.92	0.66	1.76	0.67	28	2.78	**.010**	1.05
Body Image*	3.44	1.17	3.07	1.09	31	2.62	**.013**	0.94
Social Support for Weight Management**								
Frequency	1.65	0.51	1.93	0.47	26	-3.48	**.002**	1.36
Helpful	2.10	0.70	2.73	0.73	21	-3.50	**.002**	1.53

*Lower scores indicate better eating habits, weight-related quality of life, and body image

**Higher scores indicate more time spend in physical activity, and more frequent or helpful social support

Weight. On average, completers lost 5.88% (*SD* = 4.68) of their original body weight. Seventeen participants (60.7%) achieved a clinically significant weight loss of 5% or greater, 2 participants (7.1%) achieved a weight loss between 3% and 4.9%, and 8 achieved a weight loss less than 3%. In the completer sample, participants achieving a 5% weight loss did not differ from those who did not achieve a 5% weight loss on baseline physiological measurements, and behavioral or psychological measurements. Participants achieving a weight loss of 5% or greater were significantly older (*M* = 53.88, *SD* = 7.33) than those who did not (*M* = 45.80, *SD* = 11.01), $t(25) = -2.29$, $p = .030$, $d = 0.91$.

In the ITT sample, participants lost a mean of 4.57% (*SD* = 4.80) of their original weight. The same 17 completers (47.2%) achieved a clinically significant weight loss of 5% or greater, 2 participants (5.4%) achieved a weight loss between 3% and 4.9%, and 8 achieved a weight loss less than 3%, and 16 participants achieved a weight loss less than 3%. Like the completer sample, ITT participants achieving a 5% weight loss did not differ from those who did not achieve a 5% weight loss on baseline physiological measurements, and behavioral or psychological measurements. Participants achieving a weight loss of 5% or greater were significantly older (*M* = 53.88, *SD* = 7.33) than those who did not (*M* = 43.88, *SD* = 11.16), $t(33) = -3.11$, $p = .004$, $d = 1.08$. Paired samples t-tests revealed that on average, participants in both completer and ITT samples achieved significant reductions in weight, BMI, and waist circumference.

Physiological outcomes. In both completer and ITT samples, participants achieved significant improvements from baseline to post-treatment in plasma triglycerides and fasting blood glucose. Additionally, completer and ITT participants achieved significant improvements in systolic blood pressure and diastolic blood pressure. Both completer and ITT participants did

not achieve significant changes in total cholesterol, HDL cholesterol, LDL cholesterol, or hemoglobin A1c.

Behavioral and psychological outcomes.

Food Consumption. On the FFQ, completer and ITT participants achieved significant improvements in their consumption of meat. There were no significant changes in participants' avoidance of fat, modifications or substitutions of dietary fat, and vegetable consumption, or overall eating habits.

Physical Activity. On the IPAQ, participants in the completer and ITT samples significantly increased the total time spent engaged in physical activity, with significant increases in time spent engaged in moderate physical activity. Although participants increased their time spent engaged in vigorous physical activity and walking, these increases were not significant.

Weight-Related Quality of Life. IWQOL results revealed that completer and ITT participants experienced significant improvements in overall weight-related quality of life, and quality of life related to self-esteem. No significant changes were observed on the IWQOL subscales assessing physical functioning, sexual life, public distress, or work for either the completer or ITT samples.

Body Image. Results on the BSQ indicated that completer and ITT participants achieved significant improvements in overall body image from baseline to post-treatment.

Weight Management Support. WMSI results revealed that completer and ITT participants experienced a significant increase in the frequency of supportive comments, as well as an improvement in the helpfulness of comments received.

Change over time. Last observation carried forward analyses using repeated measures MANOVA with six within-subject levels (baseline, session 4, 8, 12, 16, and 20) revealed a statistically significant main effect of time effect on weight, waist circumference, total eating habits and total physical activity, $F(19, 12) = 4.06$, $p = .008$, Wilks' $\lambda = .135$, partial $\eta^2 = .865$. Given the overall significance of the MANOVA, subsequent univariate repeated measures ANOVA analyses with pairwise comparisons were conducted for each dependent variable. Table 11 presents results of the univariate repeated measures ANOVA. Table 12 presents means, standard deviations for outcome measures at each time point. Figures 2-6 illustrate changes in dependent variables over time.

Weight. One-way repeated measures ANOVA revealed that there were statistically significant decreases in weight over time. Post hoc analysis with a Bonferroni adjustment revealed that weight decreased significantly from baseline to session 4 ($M = 1.15$ kg, $SE = 0.26$, $p = .001$), from session 4 to session 8 ($M = 1.15$ kg, $SE = 0.32$, $p = .015$), from session 8 to session 16 ($M = 1.27$ kg, $SE = 0.34$, $p = .010$), and from session 16 to session 20 ($M = 0.70$ kg, $SE = 0.16$, $p = .003$). Accordingly, there were also significant decreases in BMI over time. Post hoc analyses indicated significant changes in BMI occurred from baseline to session 4 ($M = 0.42$ kg/m^2, $SE = 0.09$, $p = .001$), from session 4 to session 8 ($M = 0.41$ kg/m^2, $SE = 0.116$, $p = .014$), from session 8 to session 16 ($M = 0.476$ kg/m^2, $SE = 0.12$, $p = .005$), and from session 16 to session 20 ($M = 0.26$ kg/m^2, $SE = 0.06$, $p = .001$).

There were also statistically significant decreases in waist circumference over time. Post hoc analysis revealed that participants' waist circumference decreased significantly from baseline to session 4 ($M = 0.96$ cm, $SE = 0.28$, $p = .029$), and from session 4 to session 8 ($M = 1.55$ cm, $SE = 0.45$, $p = .028$).

Table 11

Univariate repeated measures ANOVA for the effects of time on weight status, food consumption patterns, and physical activity patterns (n = 36)

	df	*F*	*p*	η^2
Weight Status				
Weight (kg)	1.27, 44.65	19.33	**<.001**	.36
BMI (kg/m^2)	1.34, 46.88	21.31	**<.001**	.38
Waist Circumference (cm)	2.78, 91.88	14.03	**<.001**	.29
Psychological & Behavioral Measures				
Eating habits*				
Meat	2.38, 17.21	19.33	**.003**	.12
Fat	3.49, 111.73	2.20	.082	.06
Vegetables	3.98, 127.52	1.25	.292	.03
Modifications/substitutions	3.41, 105.92	1.57	.195	.04
Total	3.39, 105.23	2.43	.061	.07
Physical Activity Patterns**				
Vigorous	3.73, 123.16	1.62	.176	.04
Moderate	1.42, 47.13	1.36	.259	.04
Walking	2.96, 97.66	2.88	**.040**	.08
Total	2.16, 71.36	2.50	**.032**	.07

Note. Greenhouse-Geisser corrected univariate tests were reported when Mauchly's Test of Sphericity was significant

Table 12

Means and standard deviations of outcome measures at baseline, and sessions 4, 8, 12, 16, and post treatment for all participants (ITT analyses: end-point carried forward)

	Baseline	Session 4	Session 8	Session 12	Session 16	Session 20
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Weight Status						
Weight (kg)	97.69 (28.24)[a]	96.53(28.02)[b]	95.38(27.86)[c]	94.70(27.76)[c,d]	94.10(27.79)[d]	93.39(27.89)[e]
BMI (kg/m^2)	36.09(7.61)[a]	35.67(7.58)[b]	35.25(7.62)[c]	35.01(7.70)[c,d]	34.78(7.70)[d]	34.51(7.79)[e]
Waist Circumference (cm)	109.24(18.08)[a]	108.33(18.59)[b]	106.75(18.61)[c,d]	106.68(18.46)[b,c,d]	105.28(19.02)[d]	105.58(19.07)[d]
Psychological & Behavioral Measures						
Eating habits*						
Meat	2.78 (0.49)[a]	2.69(0.55)[a,b]	2.51(.52)[b]	2.51(0.47) [a,b]	2.55(0.49) [a,b]	2.53(0.49) [a,b]
Fat	2.74(0.42)	2.62(0.41)	2.56(0.49)	2.61(0.39)	2.59(0.37)	2.61(0.36)
Vegetables	3.07(0.71)	3.13(0.69)	3.15(0.65)	3.01(0.73)	3.19(0.69)	3.18(0.62)
Modifications/substitutions	3.20(0.49)	3.20(0.58)	3.08(0.52)	3.08(0.56)	3.05(0.59)	3.08(0.56)
Total	2.96(0.41)	2.91(0.37)	2.82(0.39)	2.80(0.36)	2.84(0.37)	2.85(0.33)
Physical Activity Patterns**						
Vigorous	34.70(77.19)	36.17(66.48)	38.08(69.27)	47.05(73.10)	63.38(87.32)	63.82(96.04)
Moderate	51.91(94.64)	58.67(80.95)	125.52(220.22)	237.72(760.89)	144.85(275.28)	103.82(113.73)
Walking	138.38(125.59)	147.20(157.73)	279.02(339.71)	198.00(159.14)	216.17(195.68)	241.91(304.97)
Total	223.97(212.88)[a,b]	242.05(205.76)[a]	442.64(455.83)[b,c]	482.77(776.42)[c]	424.41(370.29)[c]	409.55(398.76)[a,c]

Means with different superscripts differ significantly from each other ($p < .05$)

*Lower scores indicate better eating habits

**Higher scores indicate more time spend in physical activity

Figure 2. Change in weight (kg) over time.

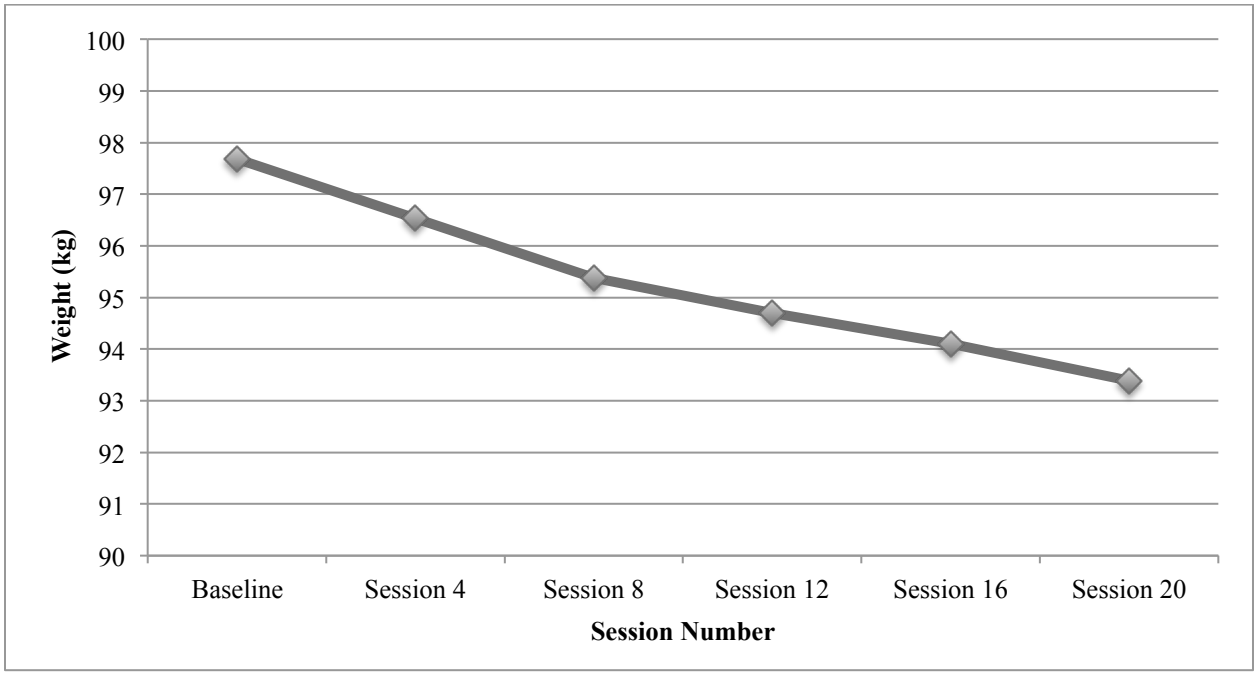


Figure 3. Change in BMI (m/kg^2) over time

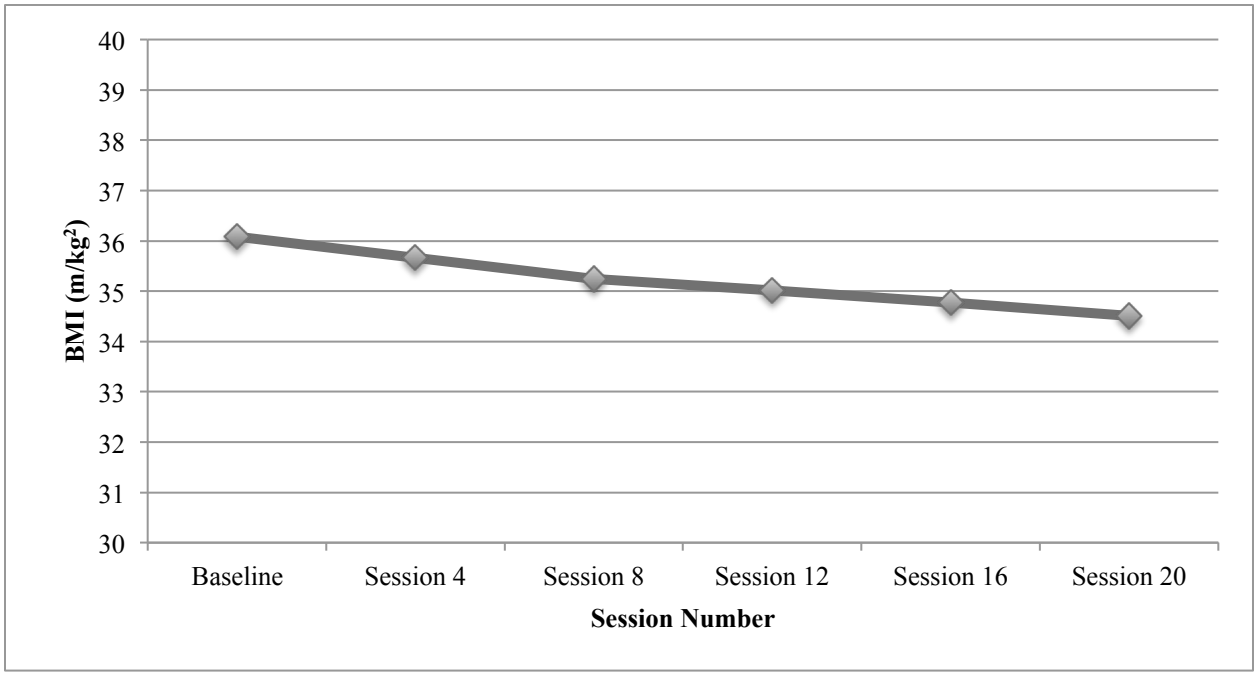


Figure 4.Change in waist circumference (cm) over time

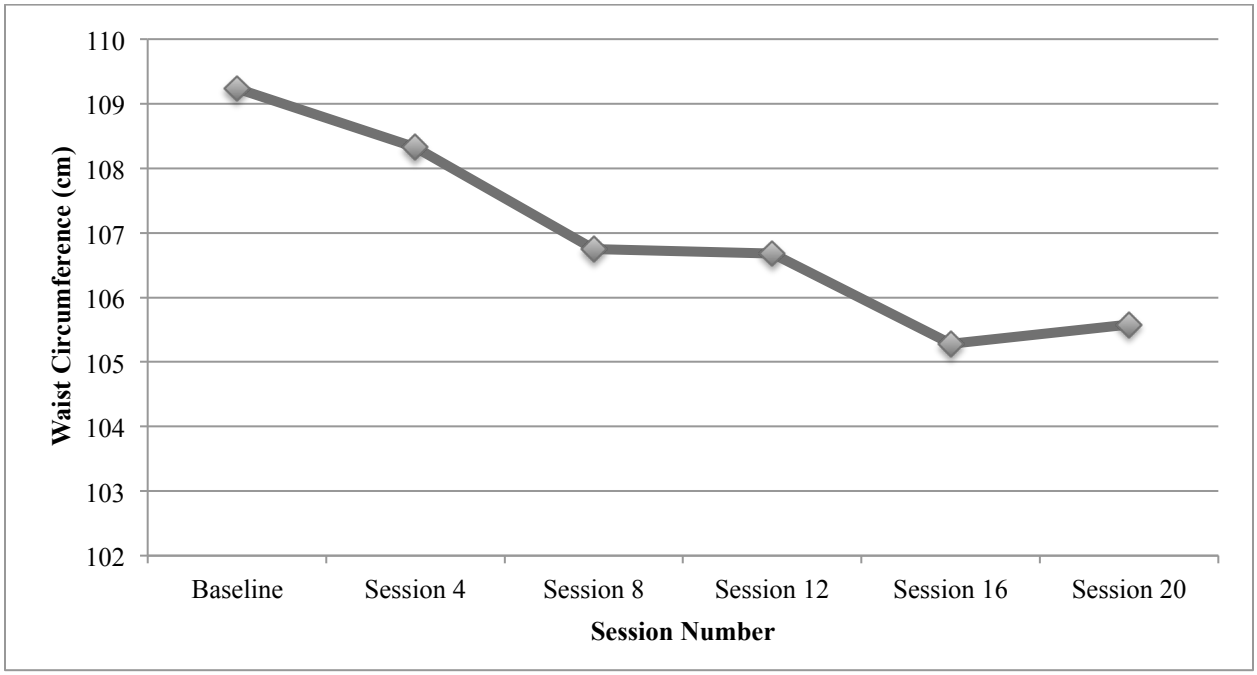


Figure 5. Change in eating habit scores (FFQ) over time

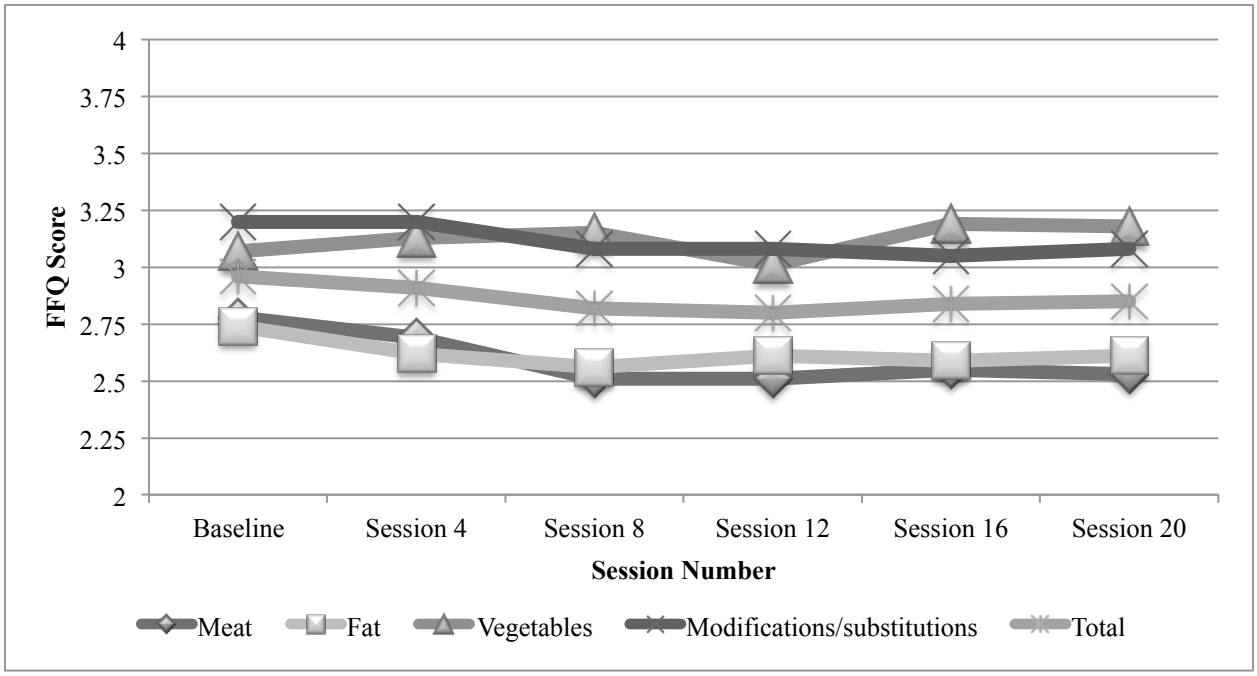
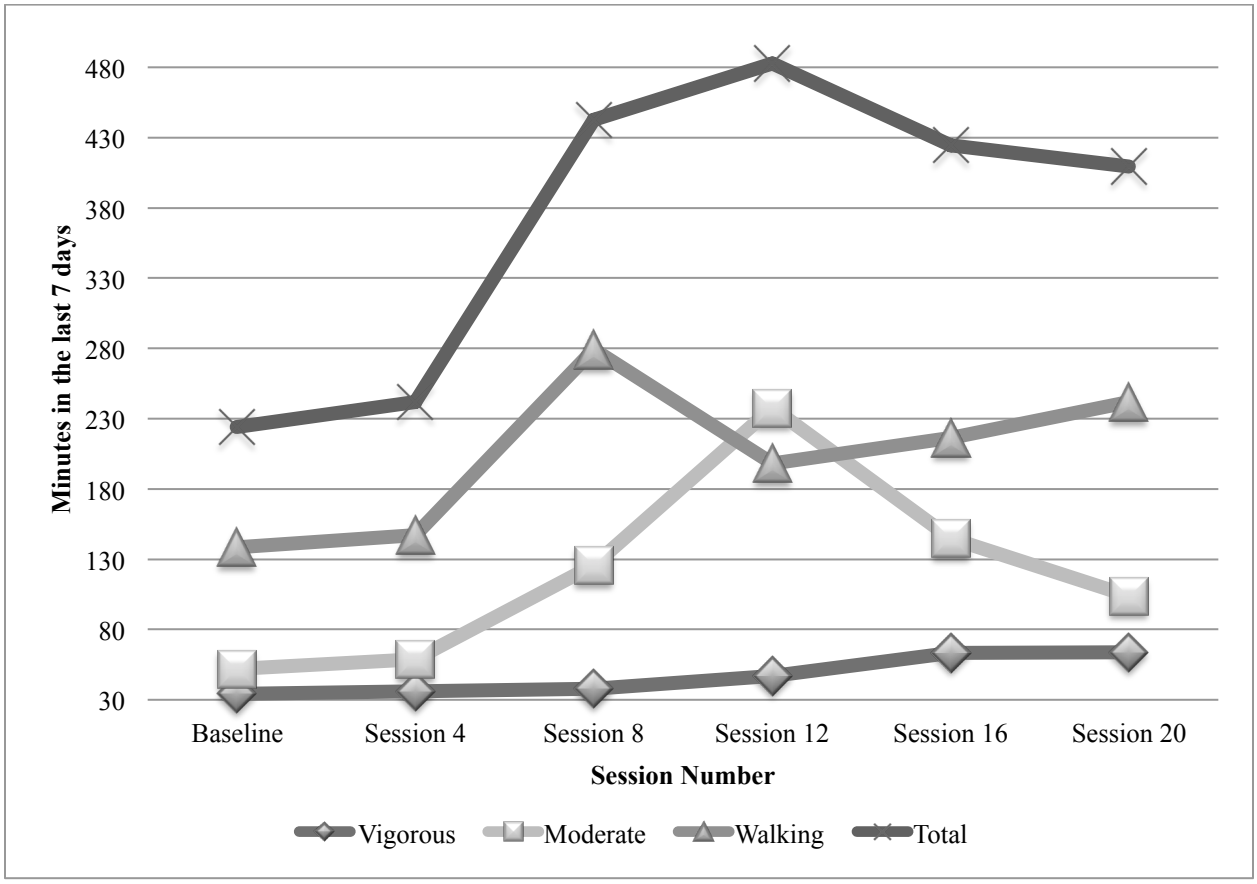


Figure 6. Change in physical activity (IPAQ) scores over time



Eating Habits. There were statistically significant improvements in participants' meat consumption patterns over time. Post hoc analyses indicated that there were no significant differences in meat consumption patterns between any time points except for a significant difference between baseline and session 12, (M = -.288, SE = .08, p = .028). There were no statistically significant changes over time in participants' overall eating patterns, or their consumption patterns of fats, vegetables, and modifications or substitutions of dietary fat.

Physical Activity. There were statistically significant increases over time in participant's overall physical activity. Post hoc analyses revealed significant differences in overall physical activity between baseline and session 16, (M = -200.44 minutes in the last 7 days, SE = 50.50, p

= .006), session 4 and session 12 (M = -200.58 minutes in the last 7 days, SE = 60.04, p = .031), and session 4 and session 16 (M = -182.35 minutes in the last 7 days, SE = 57.26, p = .047).

There were also significant changes increases time in participants' time spent walking, but post hoc tests revealed no statistically significant changes between sessions. There were no significant changes over time in participants' vigorous physical activity or moderate physical activity.

Social support and weight change

Using both the completer and ITT samples, a series of multiple regressions were run to predict post-treatment weight outcomes from pre- and post-treatment frequency of weight management support, while accounting for baseline weight. Regression coefficients and standard errors for all multiple regressions run are displayed in Table 13.

In the completer sample, the multiple regression model significantly predicted post-treatment weight, $F(3, 15) = 97.51$, $p < .001$, adj. $R^2 = .941$, but only baseline weight contributed significantly to the prediction. In the ITT sample, the model significantly predicted post-treatment weight, $F(3, 23) = 175.438$, $p < .001$, adj. $R^2 = .953$, with baseline weight and baseline frequency of weight management support contributing significantly to the prediction.

Similarly, in the completer sample, the multiple regression model significantly predicted post-treatment BMI, $F(3, 15) = 50.61$, $p < .001$, adj. $R^2 = .892$, with only baseline BMI contributing significantly to the prediction. In the ITT sample, the multiple regression model significantly predicted post-treatment BMI, $F(3, 23) = 105.49$, $p < .001$, adj. $R^2 = .923$, with baseline BMI and baseline frequency of weight management support contributing significantly to the prediction.

Table 13

Summary of multiple regression analyses

	B		SE_β		β	
	Completer	ITT	Completer	ITT	Completer	ITT
Prediction of post-treatment weight						
Intercept	-0.85	-0.93	8.73	5.24		
Pre-treatment Weight	0.87	0.90	0.05	0.04	0.98***	0.95***
Pre-treatment WMSI frequency	0.23	0.29	0.11	0.09	0.12	0.18**
Post-treatment WMSI frequency	-0.07	-0.16	0.13	0.09	-0.03	-0.09
Prediction of post-treatment BMI						
Intercept	-2.31	-1.73	3.96	2.39		
Pre-treatment BMI	0.92	0.94	0.07	0.05	0.96***	0.92***
Pre-treatment WMSI frequency	0.08	0.10	0.04	0.03	0.16	0.22**
Post-treatment WMSI frequency	-0.01	-0.04	0.05	0.03	-0.02	-0.10
Prediction of post-treatment waist circumference						
Intercept	1.649	-0.64	4.10	2.66		
Pre-treatment Waist Circumference	0.938	0.96	0.07	0.05	.91***	.089***
Pre-treatment WMSI frequency	0.100	0.12	0.03	0.02	0.21*	0.30***
Post-treatment WMSI frequency	-0.102	-0.09	0.04	0.03	-0.18*	-0.21**
Prediction of post-treatment weight						
Intercept	9.956	2.88	7.22	5.69		
Pre-treatment Weight	0.845	0.89	0.05	0.04	0.97***	0.96***
Pre-treatment WMSI helpfulness	-0.064	0.08	0.09	0.06	-0.03	0.06
Post-treatment WMSI helpfulness	0.010	-0.02	0.06	0.06	0.01	-0.02
Prediction of post-treatment BMI						
Intercept	1.583	-0.91	3.15	2.12		
Pre-treatment BMI	0.911	0.97	0.03	0.05	0.95***	0.96***
Pre-treatment WMSI helpfulness	-0.017	0.02	0.02	0.02	-0.03	0.06
Post-treatment WMSI helpfulness	0.002	-0.01	0.07	0.02	0.01	-0.03
Prediction of post-treatment waist circumference						
Intercept	-0.169	-2.47	4.76	3.19		
Pre-treatment Waist Circumference	0.963	0.99	0.10	0.07	0.94***	0.92***
Pre-treatment WMSI helpfulness	0.007	0.03	0.03	0.02	0.01	0.12
Post-treatment WMSI helpfulness	-0.007	-0.01	0.02	0.02	-0.02	-0.03

Note. *B* = unstandardized regression coefficient; SE_β = standard error of the coefficient; β = standardized coefficient

* $p < .05$; ** $p < .01$; *** $p < .001$

In the completer sample, the multiple regression model significantly predicted post-treatment waist circumference, $F(3, 15) = 56.88$, $p < .001$, adj. $R^2 = .903$. In the ITT sample, the multiple regression model significantly predicted post-treatment waist circumference, $F(3, 23) = 124.309$, $p < .001$, adj. $R^2 = .934$. In both models, all three variables added statistically significantly to the prediction, $p < .05$.

An additional set of multiple regressions were run to predict post-treatment weight outcomes from pre- and post-treatment helpfulness of weight management support, while accounting for baseline weight using both the completer and ITT sample. In these analyses, all the models significantly predicted post-treatment, weight, BMI, and waist circumference, $p < .05$. However, for each model only baseline weight outcomes added statistically significantly to each respective prediction.

Community versus worksite treatment outcomes

Participants and procedure. As described in greater detail in Latner et al. (2013), the community sample consisted of 90 participants recruited from ten community organizations. Community sample participants were recruited using the same inclusion and exclusion criteria as the worksite sample. Thirty-eight (75% female) community participants received the same 20 sessions of behavioral weight loss as the worksite participants over a six-month period starting in 2008. The remaining 42 community participants received a slightly different version of the protocol. Participants in the sample receiving the same treatment to the HMSA-LBP were used for comparison in this study. Community participants were assessed at baseline and post-treatment on the variables of weight, body mass index, waist circumference, blood pressure, plasma triglycerides, cholesterol including HDL and LDL, and glucose. Additionally,

participants filled out behavioral and psychological measures at baseline and post-treatment, including the FFQ, the IPAQ, the IWQOL, and the BSQ.

At baseline, there were no significant differences between the community sample and the worksite sample on demographic variables, anthropomorphic measurements, or physiological measurements. Additionally, there were no baseline differences between the community sample and the worksite sample on the total and subscale scores for the FFQ, the BSQ, and the IWQOL. However, there were significant baseline differences between the community sample and the worksite sample in their overall time spent engaged in physical activity, $F(1, 64) = 6.51$, $p = .013$, as well as vigorous physical activity, $F(1, 60) = 17.99$, $p < .001$, moderate physical activity, $F(1, 60) = 7.56$, $p = .008$, and walking, $F(1, 64) = 12.41$, $p = .001$. In all cases, the community sample engaged in significantly more physical activity than their worksite counterparts.

Treatment adherence and completion. Community participants attended a mean of 14.05 ($SD = 5.58$) of 20 sessions. Independent samples t-tests indicated that community participants did not differ from worksite participants in the number of sessions attended, $t(72) = 0.87$, $d = 0.20$. Of the 38 participants enrolled, 22 (58%) adhered to treatment by attending 15 or more sessions and 29 (76%) completed treatment. χ^2 tests revealed no associations between treatment adherent status and treatment setting $\chi^2(1) = 0.07$, $p = .778$, and completer status and treatment setting, $\chi^2(1) = 0.82$, $p = .365$.

Treatment outcomes. ITT analyses using repeated measures mixed MANOVA with one within-subject factor (time: baseline and post treatment) and one between-subject factor (group setting: community-based and worksite-based) revealed a statistically significant multivariate interaction between time and setting on the combined dependent variables of weight, waist circumference, systolic and diastolic blood pressure, plasma triglycerides, total cholesterol, and fasting glucose,

overall eating habits, total exercise, body image, and overall health-related quality of life, $F(11, 30) = 2.33$, $p = .032$, Wilks' $\lambda = .539$, partial $\eta^2 = .46$. Given the significance of the overall MANOVA, subsequent univariate mixed ANOVA analyses were conducted.[1] Table 14 presents the means and standard deviations for outcome measures at baseline and post-treatment for completers and baseline-carried forward ITT. Table 15 presents results for univariate mixed ANOVAs.

Weight. There was a significant main effect for time on weight for completers, and ITT, indicating a significant decrease in weight from baseline to post-treatment. There was no significant time by setting interaction for weight. Accordingly, there was a significant main effect for time on BMI for completers and ITT, but no significant time by setting interaction was observed.

For both completers and ITT, there was a significant main effect of time on waist circumference. For completers there was a significant time by setting interaction. A statistically significant simple time effect was found both in the worksite group and the community group. There was no statistically significant simple main effect of group setting for completers.

Physiological outcomes. For completers and ITT, there was a significant main effect for time on plasma triglycerides, but no significant time by setting interaction was observed for either completers or ITT.

In the completer and ITT analyses, there was no significant main effect for time or time by setting interaction for total cholesterol. There was a significant main effect for time on total

[1] Given the significant differences in physical activity between groups, additional 2x2 mixed ANCOVA analyses were conducted with total baseline physical activity included as a covariate. However, the results of the IPAQ were not significantly related to any of the dependent variables so physical activity so the covariate was omitted from final analyses.

Table 14

Community sample means and standard deviations of outcome measures at pre- and post-treatment for completers and all participants (intent-to-treat analyses)

	Completer Analysis (n = 29)		ITT Analysis (n = 38)	
	Baseline *M(SD)*	Post-Treatment *M(SD)*	Baseline *M(SD)*	Post-Treatment *M(SD)*
Weight Status				
Weight (kg)	96.94(22.51)	92.43(22.92)*	99.34(27.21)	96.02(27.83)*
BMI (kg/m^2)	35.47(6.72)	34.00(7.30)*	36.08(7.76)	34.99(8.22)*
Waist Circumference (cm)	114.37(16.84)	106.47(19.22)**	113.66(16.25)	108.25(17.80)**
Physiological measures				
Plasma triglycerides	119.95(54.17)	90.79(25.70)*	125.65(52.20)	109.35(43.49)*
Total Cholesterol	188.16(27.98)	181.26(30.39)	196.03(40.39)	192.18(42.22)
HDL Cholesterol	49.26(13.47)	52.16(13.47)	44.76(11.97)	46.38(12.66)
LDL Cholesterol	104.26(24.88)	121.11(37.15)*	112.91(26.31)	122.32(31.74)*
Fasting glucose	99.47(12.86)	94.16(9.51)*	101.15(25.41)	98.18(24.95)*
Systolic Blood Pressure	133.85(17.23)	132.23(13.24)	130.60(15.25)	130.05(13.79)
Diastolic Blood Pressure	88.00(9.67)	84.23(13.26)	84.58(10.31)	83.22(11.33)
Behavioral & Psychological Measures				
Eating habits				
Meat	2.65(0.42)	2.42(0.48)	2.62(0.53)	2.56(0.60)
Fat	2.61(0.38)	2.32(0.35)*	2.61(0.38)	2.43(0.36)*
Vegetables	2.90(0.60)	2.73(0.66)	2.94(0.68)	2.83(0.72)
Modifications/substitutions	2.87(0.69)	2.55(0.48)*	2.95(0.59)	2.76(0.52)*
Total	2.57(0.32)	2.57(0.32)	2.79(0.40)	2.67(0.36)
Physical Activity Patterns				
Vigorous	604.44(768.42)	1451.11(1699.04)	671.43(874.28)	1215.71(1518.29)
Moderate	432.22(854.25)	582.22(504.28)	406.43(745.41)	502.86(516.53)
Walking	442.03(543.09)	887.96(855.61)*	490.36(568.06)	755.13(774.34)*
Total	399.92(532.10)	2683.39(2243.11)**	487.85(586.98)	2086.28(2112.17)**
Weight-related Quality of Life				
Physical Functioning	2.57(0.90)	2.14(1.07)	2.40(0.85)	2.14(0.94)
Self Esteem	2.57(0.83)	2.45(1.20)	2.49(0.78)	2.42(1.02)
Sexual Life	1.82(0.86)	2.18(1.27)	1.90(0.87)	2.11(1.12)
Public Distress	1.70(0.72)	1.82(0.91)	1.70(0.72)	1.82(0.91)
Work	1.64(0.75)	1.66(1.05)	1.69(0.66)	1.70(0.87)
Total	2.22(0.55)	2.14(0.85)	2.16(0.46)	2.11(0.67)
Body Image	3.53(0.84)	3.05(1.17)*	3.67(0.95)	3.38(1.20)*

Note. Asterisks indicate significant differences from baseline to post-treatment, *p<.01, **p<.001

Table 15
Univariate mixed 2x2 ANOVA results for Completer and ITT

	Completer Analysis				ITT Analysis			
	df	*F*	*p*	η^2	*df*	*F*	*p*	η^2
Weight Status								
Weight (kg)								
Time	1,54	43.23	**<.001**	.44	1,71	37.22	**<.001**	.34
Time x Setting	1,54	0.41	.523	.01	1,71	0.71	.042	.01
BMI (kg/m^2)								
Time	1,54	43.80	**<.001**	.44	1,71	37.81	**<.001**	.34
Time x Setting	1,54	1.14	.289	.02	1,71	1.33	.253	.01
Waist Circumference (cm)								
Time	1,52	73.24	**<.001**	.58	1,70	49.78	**<.001**	.41
Time x Setting	1,52	5.96	**<.001**	.10	1,70	1.95	.166	.02
Physiological measures								
Plasma triglycerides								
Time	1,40	11.15	**.002**	.21	1,62	10.28	**.002**	.14
Time x Setting	1,40	0.10	.750	.00	1,62	0.03	.844	.00
Total Cholesterol								
Time	1,40	0.70	.406	.01	1,62	0.52	.470	.01
Time x Setting	1,40	0.62	.435	.01	1,62	0.44	.508	.01
HDL Cholesterol								
Time	1,40	4.21	**.047**	.09	1,62	3.91	.052	.05
Time x Setting	1,40	0.23	.628	.01	1,62	0.02	.868	.00
LDL Cholesterol								
Time	1,39	4.55	**.039**	.10	1,62	3.59	.063	.05
Time x Setting	1,39	2.31	.136	.05	1,62	1.47	.230	.02
Fasting glucose								
Time	1,40	9.91	**.003**	.199	1,62	10.05	**.002**	.14
Time x Setting	1,40	0.23	.629	.01	1,62	0.93	.339	.01
Systolic Blood Pressure								
Time	1,40	3.55	.067	.08	1,70	5.85	**.018**	.07
Time x Setting	1,40	1.79	.188	.04	1,70	4.22	**.043**	.05
Diastolic Blood Pressure								
Time	1,39	6.54	**.014**	.14	1,70	8.55	**.005**	.11
Time x Setting	1,39	0.22	.641	.01	1,70	2.45	.122	.03
Behavioral & Psychological Measures								
Eating habits								
Meat								
Time	1,38	8.50	**.006**	.18	1,62	2.22	.141	.03
Time x Setting	1,38	0.06	.798	.00	1,62	0.36	.550	.01
Fat								
Time	1,42	6.41	**.015**	.13	1,66	5.97	**.017**	.08
Time x Setting	1,42	2.27	.139	.05	1,66	2.04	.158	.03
Vegetables								
Time	1,43	0.54	.463	.01	1,65	0.51	.478	.01
Time x Setting	1,43	0.33	.568	.01	1,65	0.29	.591	.00

Table 15, continued
Univariate mixed 2x2 ANOVA results for Completer and ITT

	Completer Analysis				ITT Analysis			
	df	*F*	*p*	η^2	*df*	*F*	*p*	η^2
Behavioral & Psychological Measures, continued								
Eating habits								
Modifications/substitutions								
Time	1,37	7.82	**.008**	.17	1,63	7.15	**.010**	.10
Time x Setting	1,37	1.01	.322	.02	1,63	0.78	.378	.01
Total								
Time	1,31	2.87	.100	.08	1,60	3.05	.085	.04
Time x Setting	1,31	1.10	.301	.03	1,60	1.33	.253	.02
Physical Activity Patterns								
Vigorous								
Time	1,37	4.96	**.032**	.11	1,59	4.63	**.035**	.07
Time x Setting	1,37	3.98	.053	.09	1,59	3.88	.054	.06
Moderate								
Time	1,38	0.94	.337	.02	1,60	0.95	.33	.01
Time x Setting	1,38	0.14	.710	.00	1,60	0.13	.71	.00
Walking								
Time	1,39	17.62	**<.001**	.31	1,64	13.98	**<.001**	.17
Time x Setting	1,39	5.59	**.023**	.12	1,64	3.97	.050	.05
Total								
Time	1,38	32.92	**<.001**	.46	1,59	27.88	**<.001**	.31
Time x Setting	1,38	20.03	**<.001**	.34	1,59	18.76	**<.001**	.23
Weight-related Quality of Life								
Physical Functioning								
Time	1,42	7.03	**.011**	.14	1,61	.6.54	**.013**	.09
Time x Setting	1,42	0.24	.624	.01	1,61	0.01	.900	.00
Self Esteem								
Time	1,43	2.99	.091	.06	1,64	3.47	.067	.05
Time x Setting	1,43	0.71	.403	.01	1,64	1.20	.277	.01
Sexual Life								
Time	1,39	1.22	.274	.03	1,63	1.02	.316	.01
Time x Setting	1,39	1.22	.271	.03	1,63	1.02	.316	.01
Public Distress								
Time	1,54	0.30	.583	.01	1,63	0.46	.497	.01
Time x Setting	1,54	0.54	.465	.01	1,63	0.70	.404	.01
Work								
Time	1,41	0.32	.574	.01	1,63	0.41	.523	.01
Time x Setting	1,41	0.45	.506	.01	1,63	0.54	.464	.01
Total								
Time	1,37	3.74	.061	.09	1,62	3.99	.050	.06
Time x Setting	1,37	1.12	.296	.02	1,62	1.42	.237	.02
Body Image								
Time	1,42	15.35	**<.001**	.26	1,65	14.06	**<.001**	.17
Time x Setting	1,42	0.01	.934	.00	1,65	0.17	.679	.00

HDL for completers, but not ITT. For both completers and ITT, no significant time by setting interaction was observed on HDL cholesterol.

Similarly, there was a significant main effect for time on weight for total LDL for completers, but not ITT. For both completers and ITT, no significant time by setting interaction was observed on LDL cholesterol.

There was no main effect for time on systolic blood pressure for completers, but a significant main effect of time was observed in ITT. No significant time by setting interaction on systolic blood pressure was observed for both completers and ITT. There was a significant main effect for time on diastolic blood pressure for completers and ITT, but no significant time by setting interaction was observed.

Behavioral and psychological outcomes.

Food consumption. On the FFQ, there was a significant main effect for time on consumption of meat for completers, but not ITT. For both completers and ITT, no significant time by setting interaction was observed on the FFQ meat subscale. For both completers and ITT, there was a significant main effect for time on avoidance of fat, but no significant time by setting interaction was observed. In the completer and ITT samples, there was no significant main effect for time or time by setting interaction for vegetable consumption on the FFQ. There was a significant main effect for time on modifications or substitutions of dietary fat for completers and ITT. For both completers and ITT, no significant time by setting interaction was observed on the FFQ modifications or substitutions of dietary fat subscale. Finally, in the completer and ITT samples, there was no significant main effect for time or time by setting interaction for the total FFQ.

Physical activity. On the IPAQ, there was a significant main effect for time vigorous physical activity for completers and ITT. In both samples, there was no significant time by setting interaction for vigorous physical activity on the IPAQ.

In the completer and ITT samples, there was no significant main effect for time or time by setting interaction for moderate exercise on the IPAQ.

There was a significant main effect for time on the IPAQ walking subscale for completers and ITT. There was a significant time by setting interaction for completers, but not ITT. In completers, there was a significant simple main effect for group setting with the worksite group doing significantly less walking than the worksite group at baseline, $F(1, 64) = 12.41$, $p = .001$, partial $\eta^2 = .16$, and post-treatment, , $F(1, 40) = 8.29$, $p = .006$, partial $\eta^2 = .17$. For the worksite group, time spent walking was not significantly different between baseline and post-treatment, $F(1, 21) = 3.78$, $p = .065$, partial $\eta^2 = .15$, but time spent walking significantly increased from baseline to post-treatment in the community group, $F(1, 18) = 12.48$, $p = .002$, partial $\eta^2 = .40$.

Finally, there was a significant main effect for time on the total IPAQ scale for completers and ITT. There was a significant time by setting interaction for completers, but not ITT. In completers, there was a significant simple main effect for group setting with the worksite group doing significantly less exercise that the worksite group at baseline, $F(1, 64) = 6.51$, $p = .013$, partial $\eta^2 = .09$, and post-treatment, , $F(1, 39) = 15.50$, $p < .001$, partial $\eta^2 = .28$. Time spent exercising significantly increased from baseline to post-treatment in the worksite group, $F(1, 18) = 8.99$, $p = .008$, partial $\eta^2 = .33$, and the community group, $F(1, 20) = 30.10$, $p < .001$, partial $\eta^2 = .60$.

Weight-related quality of life. There was a significant main effect for time on the IWQOL physical functioning subscale for completers and for ITT. For both completers and ITT, no

significant time by setting interaction was observed for quality of life related to physical functioning.

In both the completer and ITT samples, there was no significant main effect for time or time by setting interaction for the IWQOL subscales assessing self esteem, sexual life, public distress, and work. Additionally, there was no significant main effect for time or time by setting interaction for the overall IWQOL scale.

Body image. On the BSQ, there was a significant main effect for time for completers, and ITT. No significant time by setting interaction was observed.

CHAPTER 5. DISCUSSION

The primary purpose of this study was to evaluate the effectiveness of a worksite administration of the Diabetes Prevention Program. The secondary goals of this study were to examine the effect of the HMSA-LBP over the course of treatment and to evaluate the role of social support in a worksite-based weight-loss program. Additionally, for exploratory purposes, comparisons between the community-based Lifestyle Balance data and the worksite data were conducted.

The HMSA-LBP demonstrated good participant adherence and retention and produced significant improvements in key physiological, behavioral, and psychological outcomes. As such, the current research adds to the growing evidence base for the effectiveness of worksite behavioral weight loss treatments. Findings from this study also suggest that frequency of social support for weight management may predict weight loss outcomes. Finally, exploratory comparisons between community and worksite data suggest that worksite treatment outcomes may not be markedly different from those seen in community settings.

Treatment adherence, completion and satisfaction

Supporting hypothesis 1, the HMSA-LBP demonstrated adequate treatment adherence, completion, and satisfaction. Together, these results replicate the participant retention rates and treatment satisfaction reported by Latner and colleagues (2013). The results also mirror the findings of several previous deliveries of behavioral weight loss treatments at other worksite settings (Aldana et al., 2005; Aldana et al., 2006; Barham et al., 2011; Dallam & Foust, 2013; Giese & Cook, 2014; Kramer et al., 2015; Townsend et al., 2016; Weinhold et al., 2015).

In this study, participants who adhered to treatment and participants who completed treatment were significantly older than participants who did not adhere to and/or complete treatment. It is possible that participant age may be related to a number of factors that impact

treatment adherence and completion—for example, younger participants may be more likely to have after-work obligations such as children to care for or second jobs. Alternatively, it is possible that younger participants are more likely to have lower-ranking positions within a company and may be less likely to be able to leave work on time to participate in after work programs. Thus, offering interventions during the workday or giving participants ways to participate remotely may enhance treatment adherence and completion. Further, it is of note that the mean age of participants in other successful community and worksite weight loss interventions also based on the Diabetes Prevention Program typically spanned from the late forties to the early sixties (e.g., Barham et al., 2011; Boltri et al., 2011; Jaber et al., 2011; Katula et al., 2011; Kramer et al., 2015; Kramer et al., 2010, Mau et al., 2010; Parikh et al., 2010; Weinhold et al., 2015). Therefore, this finding may indicate that such worksite interventions may be more appropriate for a slightly older treatment population. It is also possible that the curriculum may benefit from modifications to appeal to a wider age range.

At baseline, adherent participants (those who attended 15 or more sessions) experienced better health-related quality of life and better body satisfaction than non-adherent participants. This finding might suggest that overweight and obese individuals who experience more weight-related impairment may be more likely to miss treatment sessions. Adherent participants also reported less frequent support for weight management as well as less helpful support compared to non-adherent participants. These findings may also uphold the hypothesis that social support is related to behavioral weight loss treatment effects (Kalodner & DeLucia, 1990; Wing & Jeffery, 1999), as participants who more frequently attended treatment were receiving less frequent and less helpful social support prior to treatment. This may suggest that individuals who were receiving sufficient support prior to the intervention did not need the additional

support offered by the group setting and therefore did not adhere as well to treatment. Future studies manipulating social support variables may help to more conclusively determine the role of social support on treatment adherence. Further, as some studies have found that magnitude of weight loss is associated with the number and frequency of sessions attended (Ali et al., 2012; Jeffery & Wing, 1979; Kramer et al., 2009), future research may be necessary to identify and target individuals who are more likely to have poor treatment adherence.

Unfortunately, formal data were not collected on participants' reasons for missing sessions or withdrawing from treatment. Thus, it is difficult to determine what variables may have affected treatment adherence and completion beyond baseline characteristics. For example, in the case of two participants, attrition occurred due to unanticipated dismissals from the company. Although these participants were contacted and invited to continue treatment, they were unable to do so due to company policies that prohibit dismissed employees from entering HMSA facilities. Therefore, it is unknown what outcomes, if any, these participants would have experienced as a result of the HMSA-LBP. Although these participants were referred to community weight management programs (e.g., Weight Watchers, Kulana Hawaii), it is unknown whether or not these individuals enrolled in alternative treatments.

Similarly, although data were not systematically collected on participants' reasons for missing sessions, many participants nonetheless reported why they were unable to attend. Frequently, participants noted that they were missed sessions due to urgent work deadlines or staffing situations within their respective departments—this may be reflective of issues that may uniquely affect adherence in worksite interventions. The downstream effects of company-specific issues are also unknown—during the course of the intervention, HMSA had a company-wide hiring freeze and some employees left or were dismissed from the company and were not

replaced. As a result of these policies, some participants reported increased workload in their respective departments that may have affected their ability to regularly participate or remain in the program. Additionally, the effect of the time of day meetings were held was not evaluated—while meeting times were selected partially based on participant-reported availability at the beginning of the intervention, it is unknown how participant availability changed during the 6-month course of the intervention or as a result of changes in the company. Past research also found that in some employment settings, work priorities trumped health promotion (Geise & Cook, 2014), so it is possible that company specific and/or job-related pressures may have affected attendance and completion for some participants. Further research is necessary to determine if work policies and priorities uniquely impact interventions in worksite settings. If this is the case, future studies should investigate ways to address enhance employee adherence and completion such as ways of enhancing managerial support, including additional time management strategies as part of treatment, or investigating alternative treatment modalities to increase flexibility.

The HMSA-LBP was well received by treatment completers, as evidenced by high treatment satisfaction ratings, with mean ratings in the "satisfied" or "very satisfied" range. Despite the statistical significance of their weight losses, most participants achieved relatively modest weight reductions, as discussed below. Nevertheless, participants were generally satisfied with their weight outcomes and the changes they achieved. This level of satisfaction may reflect that even modest improvements were personally meaningful as well as clinically meaningful. Unfortunately, treatment satisfaction was only measured at Session 20, so data from non-completers was not gathered. It is possible that attrition for some of these participants was due to a less favorable view of treatment. Therefore, future studies might assess participants'

satisfaction throughout treatment in an effort to reduce attrition and more thoroughly assess treatment satisfaction across all participants.

Treatment outcomes

Pre-Treatment to Post-Treatment Outcomes. Supporting hypothesis 2 and replicating the positive findings of Latner and colleagues (2013) and other research evaluating worksite behavioral weight loss for overweight and obesity (Aldana et al., 2005; Aldana et al., 2006; Barham et al., 2011; Dallam & Foust, 2013; Giese & Cook, 2014; Kramer et al., 2015; Townsend et al., 2016; Weinhold et al., 2015), HMSA-LBP participants achieved statistically significant decreases in weight and BMI, with very large effect sizes. On average, both completers and ITT participants lost over five kilograms and nearly two BMI points, and nearly half of participants (60.7% of completers, 47.2% of all participants enrolled) achieved weight losses of 5% or greater. These finding are especially encouraging as weight loss of 5% or greater is associated with clinically meaningful improvements in adiposity-related disease risk factors. These results support the utility of the Lifestyle Balance Program for weight reduction at the worksite and provide further evidence that worksite behavioral weight loss treatments translations may be an effective component of a socio-ecological approach to managing excess adiposity.

Additionally, the statistically significant weight losses achieved by HMSA-LBP participants were also accompanied by significant improvements accompanied by large to to very large effect sizes in several key health indices, including waist circumference, plasma triglycerides, fasting blood glucose, and systolic and diastolic blood pressure. As central fat distribution, hyperlipidemia, hyperglycemia, and hypertension are contributors to metabolic syndrome, cardiovascular disease, type II diabetes mellitus, and stroke (e.g., DeFronzo &

Ferrannini, 1991; Grundy,1999; Grundy et al., 2004), these physiological findings provide evidence for the clinical significance of the weight loss observed. Combined with the large effect sizes for weight loss outcomes, these results are consistent with previous research suggesting that modest weight losses can produce significant health benefits (Ditschuneit et al., 2002; Mertens & Van Gaal, 2000; Powell et al., 2007; Tuomileho et al., 2001; Wing et al., 2011). Statistically significant improvements were not observed on participants' total cholesterol, HDL and LDL cholesterol, and hemoglobin A1c. However, on average, participants' baseline and post-treatment scores were within or near the desirable range for these variables.

The HMSA-LBP also demonstrated significant improvements accompanied by large to very large effect sizes in behavioral indicators of health, including changes in their meat-eating patterns and physical activity. Improvements in participants' consumption patterns are encouraging, as evidence from epidemiological studies has demonstrated a link between consumption of meat (particularly red meat) and risk of diabetes mellitus (Pan et al., 2011), cardiovascular disease (Micha, Wallace, Mozaffarian, 2010), and certain cancers (Zheng & Lee, 2009). Additionally, the improvements seen in physical activity are especially important as research supports that moderate and regular physical activity improves weight maintenance over time (Fogelholm & Kukkonen-Harjula, 2000; Saris et al., 2003) and significantly reduces mortality (Wen et al., 2011). Although encouraging, these findings should be interpreted with caution because the literature suggests that the accuracy of recall-based self-reported dietary intake and physical activity is questionable, particularly among weight-conscious individuals (e.g., Lafay et al., 2000; Poslusna, Ruprich, de Vries, Jakubikova, & van't Veer, 2009; Prince et al., 2008; Sallis & Saelens, 2000; Schoeller, 1995). Future studies might attempt to more

precisely measure changes these variables by utilizing data from daily food and exercise journals and/or data from real-time direct assessment methods, such as fitness trackers.

The present study also indicated that HMSA-LBP participants experienced statistically significant improvements with large to very large effect sizes on the psychological variables of overall quality of life, quality of life related to self-esteem, and body image. Overall improvements in health-related quality of life suggest that participants experienced less weight-related impairment as a result of the intervention. Additionally, significant improvements on the quality-of-life subscale measuring self-esteem indicated that participants experienced reduced their impairment related to self-consciousness and embarrassment because of their weight. This converged with the finding of significantly better post-treatment body image in HMSA-LBP participants. These improvements in psychological well-being replicate the observations of the community-based Lifestyle Balance Program (Latner et al., 2013) and are consistent with the psychological benefits that have accompanied weight losses in previous studies (e.g., Blaine et al., 2007; Maciejewski et al., 2005; Simon et al., 2010; Wadden et al., 1994; Wadden et al., 2004; Wing et al., 1984). Notably, as improvements co-occurred with modest weight losses, these findings appear to converge with past research that suggests that the relationship between the amount of weight lost and improvements in body image is not very strong (Latner & Wilson, 2011; Sarwer et al., 2005), possibly indicating that relatively small amounts of weight loss are needed to achieve improvements in body image and associated psychological factors.

At post-treatment, participants also reported significant improvements with very large effect sizes from baseline in the frequency and helpfulness of social support for weight management. As discussed below, these results may indicate that that social support may be a mechanism for the efficacy of the Lifestyle Balance Program and similar group behavioral

weight loss treatments. Additional controlled studies are necessary to experimentally evaluate the role of social support for weight loss and the capacity of group treatments to enhance social support.

Change over time. Participants achieved significant changes in weight and BMI throughout the course of the intervention, while waist circumference did not significantly change from session 12 to session 20. Participants also achieved changes in meat consumption patterns, walking, and total physical activity over time. The presence of improvements over time may provide additional evidence that participants made changes in response to the HMSA-LBP. Continued weight loss and improvements in behavioral outcomes throughout treatment may also converge with past research that has suggested that the full-dose Diabetes Prevention Program, administered as a 16-24 week-treatment, may be the most effective in producing meaningful weight loss (Ali et al, 2012; Benedict & Arterburn, 2008). However, some studies have found that worksite treatments as short as 8 to 12 sessions long are also able to produce clinically meaningful weight loss (e.g., Barham et al., 2011; Townsend et al., 2016). Given the time and resources necessary to deliver full-dose treatment, more research is necessary to determine whether short-term or less frequent treatments may be effective in worksite settings.

Social Support and Weight Change

Supporting hypothesis 3, the frequency of pre-treatment weight management support partially predicted post-treatment weight, BMI, and waist circumference in ITT HMSA-LBP participants. Additionally, post-treatment frequency of weight management support significantly predicted change in waist circumference in both the completer and ITT samples. These findings appear to converge with the literature that suggests that social support may be a predictor of treatment outcomes (e.g., Kalodner & DeLucia, 1990; Wing & Jefferey, 1999), but appear to

indicate that participants' baseline frequency of social support may have a stronger impact on weight loss outcomes than changes in frequency social support.

Although both types of social support measured increased during the intervention time frame, the relationship between social support and changes in weight outcomes cannot be determined due to the absence of experimental control in this study. Additionally, because only the overall frequency and helpfulness of social support was measured, these findings do not indicate whether social support increased as a result of peer interactions in the group sessions. Further, as the Lifestyle Balance curriculum included sessions on assertive communication and how to articulate a need for support with friends and family, it is possible that social support may have increased as a result of skills taught in the intervention. It is also possible that when members of a person's support network are aware of active weight loss attempts, the frequency of social support may naturally increase in response to these efforts. Further, although worksite participants were all coworkers in the same company, no data were collected on whether or not participants knew each other prior to treatment or received any additional social support from group members during the workday or outside of treatment. Thus, conclusions cannot be drawn on how social support change may differ as a result of shared environment and social networks. Future research might measure support received in different environments (e.g., at home, work, community, treatment group) to determine what type of social support is related to treatment outcomes. Additional studies might add more activities to enhance intra-group support to see if increasing within group support improves rates of treatment completion and adherence as well as treatment outcomes.

Community versus worksite treatment outcomes

Participants in both the HMSA-LBP and the community-based Lifestyle Balance program achieved significant improvements in key physiological, behavioral, and psychological outcomes from pre-treatment to post-treatment, virtually no interactions were observed between time and setting. Although null findings must be interpreted with caution, these results may indicate that the intervention's setting did not significantly impact treatment outcomes. Additionally, it is of note that this finding converges with the extremely limited literature that has experimentally compared differences between weight loss interventions conducted at worksites and in other settings; in two studies comparing weight loss and attrition rates between worksite and medical-site behavioral weight loss treatments, no significant differences in treatment outcomes were observed between settings (Brownell et al., 1985; Stunkard & Brownell, 1980).

The one interaction between time and setting was observed on total physical activity, with the community group doing more physical activity than the worksite group. However, at baseline, the community group was doing significantly more physical activity than their worksite counterparts, possibly because not all community members were employed, and they may have had more free time for physical activity. This baseline difference may reflect differences between individuals who may be recruited at community versus worksite settings, and more research should be conducted on relevant differences between participants in these samples.

Limitations

Although treatment outcomes from this study are promising, there are several major limitations of the current study that should be noted. The first limitation is that this study used a pre-test-post-test design rather than a randomized control trial (RCT) design. As such, it is difficult to assess where the observed changes and improvements were due to the intervention or

whether additional factors may have impacted results. However, it is important to note that both the Lifestyle Balance Program curriculum and the original Diabetes Prevention Program were previously found efficacious in randomized controlled trials (Baker et al., 2011; Diabetes Prevention Research Group 1999; 2002; Knowler et al., 2009; Latner et al., 2013). Additionally, as noted above, the findings of the HMSA-LBP converge with other Diabetes Prevention Program translation studies that utilized RCT designs (Barham et al., 2011; Kramer et al., 2015; Weinhold et al., 2015). Nevertheless, future research should try to prioritize randomized assignment to groups to assess for any unmeasured factors that may have influenced the results of the current study.

A second major consideration is that the behavioral and psychological measures used in this study were assessed using self-report. Although the measures used have evidence of their reliability and validity, these outcomes may have been vulnerable to reporter bias and potentially affected by difficulties in recall, impression management, self-deceptive enhancement and/or increased awareness of the concept being measured over time. As noted above, self-report measured of dietary intake and physical activity have been identified as particularly vulnerable to inaccuracy (e.g., Lafay et al., 2000; Poslusna et al., 2009; Sallis & Saelens, 2000; Schoeller, 1995). Additionally, given the intensive involvement required of participants in this study, it is possible that there were perceived demand characteristics that could have influenced participant report. Some studies have attempted to address this issue by utilizing a social desirability measure (Crowne & Marlowe, 1960; Paulhus, 1991), but in this study, no such measure was used in an effort to minimize study burden on participants. As a result, it is unclear how reported changes in target behaviors translate to real-world behavioral changes, and these results should be interpreted with caution. However, the presence of anthropomentric and physiological

measures may lend a degree of additional validity to the behavioral measures, given the findings in similar directions that supported each other.

A third limitation in this study is that the results may be limited in generalizability for a number of reasons. The intervention was only offered in one relatively white-collar Hawaii worksite on the island of O'ahu, and participants were relatively well educated, as the vast majority had completed at least some college. Thus, the results of the intervention are not representative of all worksites in Hawaii or elsewhere. Additionally, within the HMSA worksite, participants were self-selected and therefore possibly different from the rest of the HMSA employee population. HMSA-LBP participants may have been more motivated to make a change in their behavior relative to the average HMSA employee. Similarly, as previously mentioned, company-specific issues and the work priorities of individuals in this study may have limited generalizability. Further limiting this research, the present study's sample was also disproportionately female, which may have hindered the ability to detect gender differences in outcomes. Further, although the unique ethnic composition of the present study's sample may be considered an asset given the frequent reliance of previous studies on predominantly Caucasian samples, it may also preclude generalizations to other populations with different ethnic compositions. Finally, the small sample size of the current study may be a threat to generalizability. Due to the limited variability of participants and providers, small samples can lead to smaller effects in effectiveness research (Marchand, Stice, Rohde, & Becker, 2011). While the current study suggested positive outcomes with relatively large effect sizes that converged with similar research, future research should address these threats to generalizability by replicating this research in a larger sample, in additional employment settings, and with a greater variety of participants.

As with many weight loss trials, participant dropout and limited participant adherence were limitations in the current study. Although extensive repeated efforts were made to retain all participants (e.g., phone calls, emails), mid-treatment and post-treatment data was not available for a number of participants, which may have impacted the current study's findings. Encouragingly, the converging ITT and completer analyses in the present study suggest that potential biases associated with missing data are likely minimal (Pagoto et al., 2009). More research is necessary to investigate reasons why worksite participants may not adhere to or complete treatment. Further, future studies should investigate novel methods to retain participants throughout treatment, such as monetary incentives, food provision, and flexible modality options such as remote or online interventions.

The current study was also limited by its evaluation of the effects of the intervention at pre- and post-treatment. Although future follow-up assessments with the HMSA-LBP participants are planned, the current study did not establish whether or not the program producing lasting benefits. More research is necessary to establish the long-term effectiveness of worksite behavioral weight loss programs.

Finally, several factors severely limit the exploratory comparison between community and worksite Lifestyle Balance participants. First, the two Lifestyle Balance interventions were delivered approximately seven years apart, which likely contributed to unmeasured cohort effects between the two groups. Second, participants were not randomized to worksite or community conditions, which limits our ability to draw conclusions on the effect of setting independent of other factors. Finally, data on the occupations of participants in the Community Lifestyle Balance sample were not collected so specific hypotheses cannot be generated on potential lifestyle differences between the two groups. Given these severe limitations, the comparison

between the two studies should be interpreted with extreme caution, and more research should explore potential differences between interventions delivered in these settings.

Future Directions

As previously noted, a number of future studies are warranted to supplement this research. In addition to replicating and clarifying the findings of this study, future research may explore ways to further tailor these interventions for culturally diverse populations in Hawaii and elsewhere. While the Lifestyle Balance material included minor adaptations for Hawaii-based participants, additional efforts may be made to culturally tailor the intervention for specific patient populations. For example, the Diabetes Prevention Program curriculum was successfully adapted for individuals of Native Hawaiian, Filipino, or other Pacific Islander ethnic background (Kaholokula et al., 2014; Mau et al., 2010), and this research was extended to Native Hawaii-serving worksites (Townsend et al., 2016). The success of these interventions was in part credited to careful efforts by researchers to work with community partners to culturally adapt specific program components to the target communities. Future studies may attempt to culturally tailor behavioral weight loss programs like the HMSA-LBP to address the specific needs of diverse patient populations.

In addition to culturally adapting interventions, future studies may seek to enhance participants' ability participate in groups and regularly attend sessions. This may include having groups available at various times during the day and working closely with management to increase organizational support. Although health promotion policies enacted by executive leadership to enhance employee wellness may be an important step in bringing health-promotion programs to the worksite, the participant report in this study may indicate that mid- to lower-

level management and leadership must also enforce the balance between work and health priorities for the average employee.

Behavioral weight loss interventions may also be tailored for populations with specific medical risk factors. The current research excluded participants with major medical conditions such as cardiovascular disease, cancer, and diabetes mellitus. As individuals with these conditions may benefit the most from these interventions, future research is necessary to establish the efficacy of behavioral weight loss treatments for these populations. Additionally, efforts should be made to investigate whether these treatments can be enhanced if they are tailored to the specific needs of these groups.

Given the challenges of enrolling in a lengthy and time consuming intervention, future research may also seek to increase the flexibility of treatment and/or shorten the length of the intervention to increase treatment completion and adherence. One approach to allow for greater flexibility may be for behavioral weight loss programs to offer alternative treatment delivery modalities. For example, Kramer and colleagues (2015) investigated the effects of a worksite behavioral weight loss treatment that offered participants the option of either participating in face-to-face group treatment or to individually view DVDs of the curriculum while attending monthly group meetings. Although Kramer and colleagues (2015) did not design their study to compare the effectiveness of the two delivery modalities, researchers noted that treatment outcomes appeared to be similar between participants who participated in face-to-face groups and those who choose the DVD option. Researchers also reported that they were able to offer the DVD option in the event that a face-to-face participant was absent from a session, thereby ensuring that face-to-face participants had the opportunity to receive the "full dose" of treatment despite missed sessions. Future research may seek to investigate whether similar flexible

treatment modalities, such as video delivery of curriculum, participation via the Internet (e.g., online conferencing, forums, etc.) or remote participation (e.g., calling into treatment groups), may be prove an effective means of enhancing treatment outcomes as well as treatment completion and adherence. Such approaches may serve to fill gaps in treatment caused by missing sessions, allow individuals who may not be able to attend face-to-face groups to enroll in treatment, increase worksite participation by minimizing time away from work, and allow for dissemination of these interventions in a variety of settings.

In addition to increasing flexibility, more research is necessary to establish whether or not behavioral weight loss treatments can be delivered more efficiently without reducing the impact of the intervention. Although the Obesity Expert Panel of the National Lung, Blood, and Heart Institute concluded that high-intensity behavioral weight loss treatment are the most effective (Jensen et al., 2014), past studies have reduced the number of treatment sessions with generally positive results (e.g., Barham et al., 2011; Doldai et al., 2010; Jaber et al., 2011; Townsend et al., 2016). Further, additional studies have demonstrated that the implementation of certain key behavioral weight loss components—such as self-monitoring of caloric intake (Baker & Kirschenbaum, 1993; Boutelle & Kirschenbaum, 1998; Butryn et al., 2007; Wadden et al., 2005)—appear to most powerfully predict treatment success, suggesting that specific elements of treatment may be the "active ingredients" of treatment responsible for the changes observed. More controlled dismantling studies may be help to determine which, if any, "inactive ingredients" of behavioral weight loss programs, might be excluded from intervention packages in an effort to reduce the frequency of sessions and/or the duration of treatment.

Finally, future studies may seek to evaluate the efficacy of peer-led worksite interventions. Although the utilization of trained interventionists are typically associated with

the most effective behavioral weight loss (Jensen et al., 2014), researchers have found that laypersons with minimal training can deliver these programs with high fidelity and positive results (e.g., Abrams & Follick, 1983; Katula et al., 2011; Stunkard & Brownell, 1980; Townsend et al., 2016). Given these promising findings, future studies should expand upon the current research to investigate the effectiveness of peer-delivered programs in the worksite. If these programs are effective, peer-led worksite weight management may be a cost-effective and sustainable way to implement and disseminate these important health-promotion programs.

Conclusion

The present study adds to the effectiveness research base for worksite behavioral weight loss programs. The results of this study may indicate that worksite behavioral weight loss programs may be effective in producing clinically significant weight losses that are accompanied by significant improvements in physiological, behavioral, and psychological outcomes. However, each worksite is a unique setting, and further studies are necessary to determine the effectiveness of these interventions in additional settings.

This study additionally provides evidence for the relationship between social support and the improvements produced by behavioral weight loss programs. Given the challenges of facilitating and maintaining meaningful weight losses, these findings encourage future research aimed at enhancing behavioral weight loss outcomes and maintenance by enhancing social support.

Finally, this study suggests that the treatment outcomes achieved by worksite programs may be similar to those seen in community settings. If this is the case, it may be that the worksite is another promising arena to deliver effective treatments for obesity. Therefore,

worksite interventions may serve to increase accessibility of these treatments to treatment-seeking individuals.

In light of the severe medical, psychological, and economic impacts of the obesity epidemic, the implications of this research are promising for the ongoing implementation of community and worksite health behavioral weight loss approaches for weight management.

REFERENCES

Abrams, D. B., & Follick, M. J. (1983). Behavioral weight-loss intervention at the worksite: feasibility and maintenance. *Journal of Consulting and Clinical Psychology*, *51*(2), 226.

Ackermann, R. T., & Marrero, D. G. (2007). Adapting the diabetes prevention program lifestyle intervention for delivery in the community the YMCA model. *The Diabetes Educator*, *33*(1), 69-78.

Ackermann, R. T., Finch, E. A., Brizendine, E., Zhou, H., & Marrero, D. G. (2008). Translating the Diabetes Prevention Program into the community: the DEPLOY pilot study. *American journal of preventive medicine*, *35*(4), 357-363.

Aldana, S., Barlow, M., Smith, R., Yanowitz, F., & Adams, T. (2005). The diabetes prevention program: a worksite experience. *Workplace Health & Safety*, *53*(11), 499-505.

Aldana, S., Barlow, M., Smith, R., Yanowitz, F., Adams, T., Loveday, L., COHN-S., Merrill, R. (2006). A worksite diabetes prevention program: two-year impact on employee health. *Workplace Health & Safety*, *54*(9), 389-395.

Ali, M. K., Echouffo-Tcheugui, J. B., & Williamson, D. F. (2012). How effective were lifestyle interventions in real-world settings that were modeled on the Diabetes Prevention Program?. *Health affairs*, *31*(1), 67-75.

Allen, J., & Allen, R. (1985). From short term compliance to long term freedom: Cultural based health promotion by health professionals. *Journal of Health Promotion, 1*, 39-47.

Allon, N. (1982). The stigma of overweight in everyday life. In B. B. Wortman (Ed.), *Psychological aspects of obesity* (pp. 130-174). New York, NY: Van Nostrand Reinhold.

Amundson, H. A., Butcher, M. K., Gohdes, D., Hall, T. O., Harwell, T. S., Helgerson, S. D., & Vanderwood, K. K. (2009). Translating the diabetes prevention program into practice in the general community findings from the Montana Cardiovascular Disease and Diabetes Prevention Program. *The Diabetes Educator*, *35*(2), 209-223.

Anderson, L. M., Quinn, T. A., Glanz, K., Ramirez, G., Kahwati, L. C., Johnson, D. B., ... & Katz, D. L. (2009). The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: a systematic review. *American journal of preventive medicine*, *37*(4), 340-357.

Bachman, K. H. (2007). Obesity, weight management, and health care costs: a primer. *Disease Management*, *10*(3), 129-137.

Baker, M. K., Simpson, K., Lloyd, B., Bauman, A. E., & Singh, M. A. F. (2011). Behavioral strategies in diabetes prevention programs: a systematic review of randomized controlled trials. *Diabetes research and clinical practice*, *91*(1), 1-12.

Baker, R. C., & Kirschenbaum, D. S. (1993). Self-monitoring may be necessary for successful weight control. *Behavior Therapy*, *24*(3), 377-394.

Barham, K., West, S., Trief, P., Morrow, C., Wade, M., & Weinstock, R. S. (2011). Diabetes prevention and control in the workplace: a pilot project for county employees. *Journal of Public Health Management and Practice*, *17*(3), 233-241.

Benedict, M. A., & Arterburn, D. (2008). Worksite-based weight loss programs: a systematic review of recent literature. *American Journal of Health Promotion*, *22*(6), 408-416.

Blaine, B. E., Rodman, J., & Newman, J. M. (2007). Weight loss treatment and psychological well-being a review and meta-analysis. *Journal of Health Psychology*, *12*(1), 66-82.

Boltri, J. M., Davis-Smith, M., Okosun, I. S., Seale, J. P., & Foster, B. (2011). Translation of the national institutes of health diabetes prevention program in African American churches. *Journal of the national medical association*, *103*(3), 194-202.

Boltri, J. M., Davis-Smith, Y. M., Seale, J. P., Shellenberger, S., Okosun, I. S., & Cornelius, M. E. (2008). Diabetes Prevention in a Faith-Based Setting: Results of Translational Research. *Journal of Public Health Management and Practice*, *14*(1), 29-32.

Boulding, K. E. (1956). General systems theory-the skeleton of science. *Management Science, 2*(3), 197-208.

Boutelle, K. N., & Kirschenbaum, D. S. (1998). Further support for consistent self-monitoring as a vital component of successful weight control. *Obesity Research*, *6*(3), 219-224.

Bray, G. A. (2004). Medical consequences of obesity. *The Journal of Clinical Endocrinology and Metabolism, 89*(6), 2583-2589.

Brownell, K. D., Cohen, R. Y., Stunkard, A. J., Felix, M. R., & Cooley, N. B. (1984). Weight loss competitions at the worksite: Impact on weight, morale, and cost-effectiveness. *American Journal of Public Health, 74*, 1283-1285.

Brownell, K. D., Stunkard, A. J., & McKeon, P. E. (1985). Weight reduction at the work site: A promise partially fulfilled. *American Journal of Psychiatry, 142*, 47-52.

Butryn, M. L., Phelan, S., Hill, J. O., & Wing, R. R. (2007). Consistent self-monitoring of weight: a key component of successful weight loss maintenance. *Obesity*, *15*(12), 3091-3096.

Butryn, M. L., Webb, V., & Wadden, T. A. (2011). Behavioral treatment of obesity. *The Psychiatric clinics of North America*, *34*(4), 841.

Calle, E. E., Rodriguez, C., Walker-Thurmond, K., & Thun, M. J. (2003). Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *New England Journal of Medicine, 348*(17), 1625-1638.

Calle, E. E., Thun, M. J., Petrelli, J. M., Rodriguez, C., & Heath, C. W. (1999). Body-mass index and mortality in a prospective cohort of U.S. adults. *New England Journal of Medicine, 341*(15), 1097-1105.

Cancelliere, C., Cassidy, J. D., Ammendolia, C., & Côté, P. (2011). Are workplace health promotion programs effective at improving presenteeism in workers? A systematic review and best evidence synthesis of the literature. *BMC public health*, *11*(1), 395.

Centers for Diease Control. (2011b). *National Health and Nutrition Examination Survey (NHANES): Physician Examination Procedures Manual*. Retrieved from http://www.cdc.gov/nchs/data/nhanes/nhanes_11_12/Physician_Exam_Manual.pdf.

Centers for Disease Control. (2011a). *National Health and Nutrition Examination Survey (NHANES): Anthropometry Procedures Manual*. Retrieved from http://www.cdc.gov/nchs/data/nhanes/nhanes_11_12/Anthropometry_Procedures_Manual.pdf.

Ciao, A. C., Latner, J. D., & Durso, L. E. (2012). Treatment seeking and barriers to weight loss treatments of different intensity levels among obese and overweight individuals. *Eating and Weight Disorders, 17*(1), 9-16.

Cooper, P. J., Taylor, M. J., Cooper, Z., & Fairburn, C. G. (1987). The development and validation of the body shape questionnaire. *International Journal of Eating Disorders, 6*, 485-494.

Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., …Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise, 35*(8), 1381-1391.

Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology*, *24*(4), 349–354.

Dallam, G. M., & Foust, C. P. (2013). A comparative approach to using the diabetes prevention program to reduce diabetes risk in a worksite setting. *Health promotion practice*, *14*(2), 199-204.

Davis-Smith, Y. M., Davis-Smith, M., Boltri, J. M., Seale, J. P., Shellenberger, S., Blalock, T., & Tobin, B. (2007). Implementing a diabetes prevention program in a rural African-American church. *Journal of the National Medical Association*, *99*(4), 440.

DeFronzo, R. A., & Ferrannini, E. (1991). Insulin resistance: a multifaceted syndrome responsible for NIDDM, obesity, hypertension, dyslipidemia, and atherosclerotic cardiovascular disease. *Diabetes care*, *14*(3), 173-194.

DeJoy, D. M., & Southern, D. J. (1993). An integrative perspective on work-site health promotion. *Journal of Occupational and Environmental Medicine*, *35*(12), 1221-1230.

DePue, J. D., Clark, M. M., Ruggiero, L. Medeiros, M. L., & Pera, V. (1995). Maintenance of weight loss: A needs assessment. *Obesity Research, 3*(3), 241-248.

Diabetes Prevention Program (DPP) Research Group. (2002). The Diabetes Prevention Program (DPP) description of lifestyle intervention. *Diabetes care*, *25*(12), 2165-2171.

Diabetes Prevention Program Research Group. (1999). The Diabetes Prevention Program: design

and methods for a clinical trial in the prevention of type 2 diabetes. *Diabetes care*, *22*(4), 623.

Dishman, R. K., Oldenburg, B., O'Neal, H., & Shephard, R. J. (1998). Worksite physical activity interventions. *American Journal of Preventive Medicine, 15*(4), 344-361.

Ditschuneit, H. H., Frier, H. I., & Flechtner-Mors, M. (2002). Lipoprotein responses to weight loss and weight maintenance in high-risk obese subjects. *European Journal of Clinical Nutrition, 56*, 264-270.

Dodani, S., & Fields, J. Z. (2010). Implementation of the fit body and soul, a church-based life style program for diabetes prevention in high-risk African Americans a feasibility study. *The Diabetes Educator*, *36*(3), 465-472.

Fabricatore, A. N., & Wadden, T. A. (2006). Obesity. *Annual Review of Clinical Psychology, 2*, 357-377.

Faridi, Z., Shuval, K., Njike, V. Y., Katz, J. A., Jennings, G., Williams, M., ... & PREDICT Project Working Group. (2010). Partners reducing effects of diabetes (PREDICT): a diabetes prevention physical activity and dietary intervention through African-American churches. *Health Education Research*, *25*(2), 306-315.

Faul, F., Erdfelder, E., Lang, A., & Buchner, A. (2007). GPower 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191.

Finkelstein, E. A., DiBonaventura, M. D., Burgess, S. M., & Hale, B. C. (2010). The costs of obesity in the workplace. *Journal of Occupational and Environmental Medicine, 52*(10), 971-976.

Finkelstein, E. A., Fiebelkorn, I. C., & Wang, G. (2003). National medical spending attributable to overweight and obesity: How much, and who's paying? Health Affairs, 22(1), 219-226.

Finkelstein, E. A., Trogdon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obesity: Payer-and-service-specific estimates. Health Affairs, 28(5), 822-831.

Flegal, K. M., Carroll, M. D., Kit, B. K., & Ogden, C. L. (2012). Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *The Journal of the American Medical Association*, *307*(5), 491-497.

Fogelholm, M., & Kukkonen-Harjula, K. (2000). Does physical activity prevent weight gain–a systematic review. *Obesity reviews*, *1*(2), 95-111.

Fontaine, K. R., Cheskin, L. J., & Barofsky, I. (1996). Health-related quality of life in obese persons seeking treatment. *The Journal of Family Practice, 43*(3), 265-270.

Friedman, M. A., & Brownell, K. D. (1995). Psychological correlates of obesity: Moving to the next research generation. *Psychological Bulletin, 117*, 3-20.

Gardner, C. D., Kiazand, A., Alhassan, S., Kim, S., Stafford, R. S., Balise, R. R., … King, A. C. (2007). Comparison of the Atkins, Zone, Ornish, and LEARN Diets for change in weight and related risk factors among overweight premenopausal women: The A to Z weight loss study: A randomized trial. *Journal of the American Medical Association, 297*(9), 969-977.

Giese, K. K., & Cook, P. F. (2014). Reducing obesity among employees of a manufacturing plant: translating the Diabetes Prevention Program to the workplace. *Workplace health & safety*, *62*(4), 136-141.

Goetzel, R. Z., Hawkins, K., Ozminkowski, R. J., & Wang, S. (2003). The health and productivity cost burden of the "top 10" physical and mental health conditions affecting six large US employers in 1999. *Journal of occupational and environmental medicine*, *45*(1), 5-14.

Golaszewski, T., Barr, D., & Pronk, N. (2003). Development of assessment tools to measure organizational support for employee health. *American journal of health behavior*, *27*(1), 43-54.

Grilo, C. M., Masheb, R. M., Wilson, G. T., Gueorguieva, R., & White, M. A. (2011). Cognitive-behavioral therapy, behavioral weight loss, and sequential treatment for obese patients with binge-eating disorder: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 79*, 675-685.

Grundy, S. M. (1999). Hypertriglyceridemia, insulin resistance, and the metabolic syndrome. *The American journal of cardiology*, *83*(9), 25-29.

Grundy, S. M., Brewer, H. B., Cleeman, J. I., Smith, S. C., & Lenfant, C. (2004). Definition of metabolic syndrome report of the National Heart, Lung, and Blood Institute/American Heart Association Conference on scientific issues related to definition. *Circulation*, *109*(3), 433-438.

Hammond, R. A., & Levine, R. (2010). The economic impact of obesity in the United States. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 3, 285-295.

Harris, M. B. (1990). Is love seen as different for the obese? *Journal of Applied Social Psychology, 20*(15), 1209-1224.

Hertz, R. P., Unger, A. N., McDonald, M., Lustik, M. B., & Biddulph-Krentar, J. (2004). The impact of obesity on work limitations and cardiovascular risk factors in the US workforce. *Journal of Occupational and Environmental Medicine*, *46*(12), 1196-1203.

Heshka, S., Anderson, J. W., Atkison, R. J., Greenway, F. L., Hill, J. O., Phinney, S. D., …Pi-Sunyer, F. X. (2003). Weight loss with self-help compared with randomized trial. *JAMA, 289*, 1792-1798.

Hoke, C. N., & Franks, S. (2002). Work site, physician's office, or medical university clinic: The effect of setting on success in a multidisciplinary weight-loss program. *Eating Behaviors, 3*(1), 93-100.

Jaber, L. A., Pinelli, N. R., Brown, M. B., Funnell, M. M., Anderson, R., Hammad, A., & Herman, W. H. (2011). Feasibility of group lifestyle intervention for diabetes prevention in Arab Americans. *Diabetes research and clinical practice*, *91*(3), 307-315.

Jackson, L. (2009). Translating the Diabetes Prevention Program Into Practice A Review of Community Interventions. *The Diabetes Educator*, *35*(2), 309-320.

Jeffery, R. W., & Wing, R. R. (1979). Frequency of therapist contact in the treatment of obesity. *Behavior Therapy*, *10*(2), 186-192.

Jeffery, R. W., Gillum, R., Gerber, W. M., Jacobs, D., Elmer, P. J., & Prineas, R. J. (1983). Weight and sodium reduction for the prevention of hypertension: A comparison of group treatment and individual counseling. *American Journal of Public Health, 73*, 691-693.

Jensen, M. D., Ryan, D. H., Donato, K. A., Apovian, C. M., Ard, J. D., Comuzzie, A. G., ... & Loria, C. M. (2014). Executive summary: Guidelines (2013) for the management of overweight and obesity in adults. *Obesity*, *22*(S2), S5-S39.

Kaholokula, J. K., Wilson, R. E., Townsend, C. K. M., Zhang, G. X., Chen, J., Yoshimura, S. R., ... & Hughes, C. K. (2014). Translating the Diabetes Prevention Program in Native Hawaiian and Pacific Islander communities: the PILI ‘Ohana Project. *Translational behavioral medicine*, *4*(2), 149-159.

Kalodner, C. R., & DeLucia, J. L. (1990). Components of effective weight loss program: Theory, research, and practice. Journal of Counseling & Development, 68(4), 427-433.

Katula, J. A., Vitolins, M. Z., Rosenberger, E. L., Blackwell, C. S., Morgan, T. M., Lawlor, M. S., & Goff, D. C. (2011). One-year results of a community-based translation of the diabetes prevention program Healthy-Living Partnerships to Prevent Diabetes (HELP PD) project. *Diabetes Care*, *34*(7), 1451-1457.

Katz, D. L., O’Connell, M., Yeh, M. C., Nawaz, H., Njike, V., Anderson, L. M., ... Task Force on Community Preventive Services. (2005). Public health strategies for preventing and controlling overweight and obesity in school and worksite settings. *MMWR Recommendations and Reports, 54*(2).

Kim, S., & Popkin, B. M. (2006). Commentary: Understanding the epidemiology of overweight and obesity- a real global public health concern. *International Journal of Epidemiology, 35*(1), 60-67.

Klein, S., Burke, L. E., Bray, G. A., Blair, S., Allison, D, B., Pi-Sunyer, X., … Eckel, R. H. (2004). Clinical implications of obesity with specific focus on cardiovascular disease: A statement for professionals from the American Heart Association council on nutrition, physical activity and metabolism: Endorsed by the American College of Cardiology Foundation. *Circulation, 110*, 2952-2967.

Knowler, W. C., Fowler, S. E., Hamman, R. F., Christophi, C. A., Hoffman, H. J., Brenneman, A. T., ... & Nathan, D. M. (2009). 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. *Lancet (London, England)*, *374*(9702),

1677-1686.

Kolotkin, R. L. & Crosby, R. D. (2002). Psychometric evaluation of the impact of weight on quality of life-lite questionnaire (IWQOL-Lite) in a community sample. *Quality of Life Research, 11*(2), 157-171.

Kolotkin, R. L., Crosby, R. D., Kosloski, K. D., & Williams, G. R. (2001). Development of a brief measure to assess quality of life in obesity. *Obesity Research, 9*, 102-111.

Kramer, M. K., Kriska, A. M., Venditti, E. M., Miller, R. G., Brooks, M. M., Burke, L. E., ... & Orchard, T. J. (2009). Translating the Diabetes Prevention Program: a comprehensive model for prevention training and program delivery. *American journal of preventive medicine*, *37*(6), 505-511.

Kramer, M. K., Molenaar, D. M., Arena, V. C., Venditti, E. M., Meehan, R. J., Miller, R. G., ... & Kriska, A. M. (2015). Improving employee health: evaluation of a worksite lifestyle change program to decrease risk factors for diabetes and cardiovascular disease. Journal of Occupational and Environmental Medicine, 57(3), 284-291.

Kristal, A. R., Beresford, S. A., & Lazovich, D. (1994). Assessing change in diet-intervention research. *The American Journal of Clinical Nutrition, 59*(1), 185-189.

Kristal, A. R., Shattuck, A. L., & Henry, H. J. (1990). Patterns of dietary behavior associated with selecting diets low in fat: Reliability and validity of a behavioral approach to dietary assessment. *Journal of the American Dietetic Association, 90*, 214-220.

Kristal, A. R., White, E., Shattuck, A. L., Curry, S. J., Anderson, G. L., & Urban, N. (1992). Long-term maintenance of low-fat diet: Durability of fat-related dietary habits in the Women's Health Trial. *Journal of the American Dietetic Association, 92*(5), 553-559.

Lafay, L., Mennen, L., Basdevant, A., Charles, M. A., Borys, J. M., Eschwege, E., & Romon, M. (2000). Does energy intake underreporting involve all kinds of food or only specific food items? Results from the Fleurbaix Laventie Ville Sante (FLVS) study. *International Journal of Obesity & Related Metabolic Disorders*, *24*(11).

Latner, J. D., & Wilson, R. E. (2011). Obesity and body image in adulthood. In T. F. Cash & L. Smolak (Eds.), *Body image: A handbook of science, practice, and prevention* (2nd ed., pp. 189-197). New York, NY: The Guilford Press.

Latner, J. D., Ciao, A. C., Wendicke, A. U., Murakami, J. M., & Durso, L. E. (2013). Community-based behavioral weight-loss treatment: Long-term maintenance of weight loss, physiological, and psychological outcomes. *Behaviour Research and Therapy, 51*(8), 451-459.

Lawrence, V. J., & Kopelman, P. G. (2004). Medical consequences of obesity. *Clinics in Dermatology, 22*(4), 296-302.

Levy, J., Segal, L. M., Thomas, K., St. Laurent, R., Lang, A., & Rayburn, J. (2013). F as in Fat: How obesity threatens America's future 2013. *Trust for America's Health and the Robert Wood Johnson Foundation*.

Lewis, C. E., McTigue, K. M., Burke, L. E., Poirier, P., Eckel, R. H., Howard, B. V., … PiSunyer, F. X. (2009). Mortality, health outcomes, and body mass index in the overweight range: A science advisory from the American Heart Association. *Circulation, 119*(25), 3263-3271.

Maciejewski, M. L., Patrick, D. L., & Williamson, D. F. (2005). A structured review of randomized controlled trials of weight loss showed little improvement in health-related quality of life. *Journal of clinical epidemiology*, *58*(6), 568-578.

Marchand E, Stice E, Rohde P, Becker CB. (2011). Moving from efficacy to effectiveness trials in prevention research. *Behavior Research and Therapy, 49,* 32-41.

Matvienko, O. A., & Hoehns, J. D. (2009). A lifestyle intervention study in patients with diabetes or impaired glucose tolerance: translation of a research intervention into practice. *The Journal of the American Board of Family Medicine*, *22*(5), 535-543.

Mau, M. K., Kaholokula, J. K. A., West, M. R., Leake, A., Efird, J. T., Rose, C., ... & Gomes, H. (2010). Translating diabetes prevention into native Hawaiian and Pacific Islander communities: the PILI ‘Ohana Pilot project. *Progress in community health partnerships: research, education, and action*, *4*(1), 7.

Mayer-Davis, E. J., D'Antonio, A. M., Smith, S. M., Kirkner, G., Levin Martin, S., Parra-Medina, D., & Schultz, R. (2004). Pounds off with empowerment (POWER): a clinical trial of weight management strategies for black and white adults with diabetes who live in medically underserved rural communities. *American Journal of Public Health*, *94*(10), 1736-1742.

McDonald, T., ... & Orchard, T. J. (2010). A novel approach to diabetes prevention: evaluation of the Group Lifestyle Balance program delivered via DVD. *Diabetes research and clinical practice*, *90*(3), e60-e63.

Mertens, I. L., & Van Gaal, L. F. (2000). Overweight, obesity, and blood pressure: The effects of modest weight reduction. *Obesity Research, 8*(3), 270-278.

Micha, R., Wallace, S. K., & Mozaffarian, D. (2010). Red and processed meat consumption and risk of incident coronary heart disease, stroke, and diabetes mellitus a systematic review and meta-analysis. *Circulation*, *121*(21), 2271-2283.

Miller, A., & Edelstein, S. (1990). Establishing a work-site wellness program in a hospital setting. *Journal of the American Dietetic Association, 90*, 1104-1106.

Ozminkowski, R. J., Ling, D., Goetzel, R. Z., Bruno, J. A., Rutter, K. R., Isaac, F., & Wang, S. (2002). Long-term impact of Johnson & Johnson’s Health & Wellness Program on health care utilization and expenditures. *Journal of Occupational and Environmental Medicine*, *44*(1), 21-29.

Pagoto, S. L., Kozak, A. T., John, P., Bodenlos, J. S., Hedeker, D., Spring, B., & Schneider, K. L. (2009). Intention-to-treat analyses in behavioral medicine randomized clinical trials. *International journal of behavioral medicine*, *16*(4), 316-322.

Pan, A., Sun, Q., Bernstein, A. M., Schulze, M. B., Manson, J. E., Willett, W. C., & Hu, F. B. (2011). Red meat consumption and risk of type 2 diabetes: 3 cohorts of US adults and an updated meta-analysis. *The American journal of clinical nutrition*, *94*(4), 1088-1096.

Parikh, P., Simon, E. P., Fei, K., Looker, H., Goytia, C., & Horowitz, C. R. (2010). Results of a pilot diabetes prevention intervention in East Harlem, New York City: Project HEED. *American journal of public health*, *100*(S1), S232-S239.

Paulhus, D. L. (1991). Measurement and control of response biases. In J. P. Robinson, P. Shaver, & L. S. Wrightsman (Eds.), *Measures of personality and social psychological attitudes*. San Diego: Academic Press.

Peregrin, T. (2005). Weighing in on corporate wellness programs and their impact on obesity. *Journal of the American Dietetic Association, 105*, 1192-1194.

Popkin, B. M., Kim, S., Rusev, E. R., Du, S., & Zizza, C. (2006). Measuring the full economic costs of diet, physical activity and obesity-related chronic diseases. *Obesity Reviews, 7*, 271-293.

Poslusna, K., Ruprich, J., de Vries, J. H., Jakubikova, M., & van't Veer, P. (2009). Misreporting of energy and micronutrient intake estimated by food records and 24 hour recalls, control and adjustment methods in practice. *British Journal of Nutrition*, *101*(S2), S73-S85.

Powell, L. H., Calvin, J. E., & Calvin, J. E. (2007). Effective obesity treatments. *American Psychology, 62*(3), 234-246.

Prince, S. A., Adamo, K. B., Hamel, M. E., Hardt, J., Gorber, S. C., & Tremblay, M. (2008). A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *5*(1), 56.

Puhl, R. M., & Brownell, K. D. (2001). Bias, discrimination, and obesity. *Obesity Research, 9*, 788-805.

Puhl, R. M., & Heuer, C. A. (2009). The stigma of obesity: A review and update. *Obesity, 17*(5), 941-964.

Puhl, R. M., & Latner, J. D. (2007). Stigma, obesity, and the health of the nation's children. *Psychological Bulletin, 133*(4), 557-580.

Renjilian, D. A., Perri, M. G., Nezu, A. M., McKelvey, W. F., Shermer, R. L., & Anton, S. D. (2001). Individual versus group therapy for obesity: effects of matching participants to their treatment preferences. *Journal of consulting and clinical psychology*, *69*(4), 717.

Rieder, S., & Ruderman, A. (2007). The development and validation of the weight management support inventory. *Eating behaviors*, *8*(1), 39-47.

Robert Wood Johnson Foundation and the Trust for America's Health (2013). F as in Fat: How Obesity Threatens America's Future 2013. Retrieved September 09, 2014 from http://healthyamericans.org/assets/files/TFAH2013FasInFatReportFinal%209.0.pdf

Sallis, J. F., & Saelens, B. E. (2000). Assessment of physical activity by self-report: status, limitations, and future directions. *Research quarterly for exercise and sport*, *71*(sup2), 1-14.

Saris, W. H. M., Blair, S. N., Van Baak, M. A., Eaton, S. B., Davies, P. S. W., Di Pietro, L., ... & Tremblay, A. (2003). How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO 1st Stock Conference and consensus statement. *Obesity reviews*, *4*(2), 101-114.

Sarlio-Lahteenkorva, S., Stunkard, A., & Rissanen, A. (1995). Psychosocial factors and quality of life in obesity. *International Journal of Obesity, 19*, 1–5.

Sarwer, D. B., Thompson, J. K., & Cash, T. F. (2005). Body image and obesity in adulthood. *Psychiatric Clinics of North America, 28*, 69-87.

Schoeller, D. A. (1995). Limitations in the assessment of dietary energy intake by self-report. *Metabolism*, *44*, 18-22.

Seidel, M. C., Powell, R. O., Zgibor, J. C., Siminerio, L. M., & Piatt, G. A. (2008). Translating the Diabetes Prevention Program Into an Urban Medically Underserved Community A nonrandomized prospective intervention study. *Diabetes Care*, *31*(4), 684-689.

Simon, G. E., Rohde, P., Ludman, E. J., Jeffery, R. W., Linde, J. A., Operskalski, B. H., & Arterburn, D. (2010). Association between change in depression and change in weight among women enrolled in weight loss treatment. *General hospital psychiatry*, *32*(6), 583-589.

Soler, R. E., Leeks, K. D., Razi, S., Hopkins, D. P., Griffith, M., Aten, A., ... Walker, A. M. (2010). A systematic review of selected interventions for worksite health promotion: The assessment of health risks with feedback. *American Journal of Preventive Medicine*, *38*(2), S237-S262.

Stokols, D. (1992). Establishing and maintain healthy environments toward a social ecology of health promotion. *American Psychologist, 47*, 6-22.

Stokols, D. (1996). Translating social ecological theory into guidelines for community health promotion. American Journal of Health Promotion, 10(4), 282-298.

Stokols, D., Grzywacz, J. G., McMahan, S., & Phillips, K. (2003). Increasing the health promotive capacity of human environments. *American Journal of Health Promotion*, *18*(1), 4-13.

Stokols, D., Pelletier, K. R., & Fielding, J. E. (1996). The ecology of work and health: research and policy directions for the promotion of employee health. *Health Education & Behavior*, *23*(2), 137-158.

Stunkard, A. J., & Brownell, K. D. (1980). Work-site treatment for obesity. *American Journal of psychiatry, 137*, 252-253.

Sullivan, M. B. E., Sullivan, L. G. M., & Kral, J. G. (1987). Quality of life assessment in obesity: physical, psychological and social function. *Gastroenterology Clinics of North America, 16*(3), 433–442.

Sullivan, M., Karlsson, J., Sjostrom, L., Backman, L., Bengtsson, C., Bouchard, C., … Lindstedt, S. (1993). Swedish obese subjects (SOS): An intervention study of obesity. Baseline evaluation of health and psychosocial functioning in the first 1743 subjects examined. *International Journal of Obesity and Related Metabolic Disorders: Journal of the International Association for the Study of Obesity, 17*(9), 503-512.

Svetkey, L. P., Stevens, V. J., Brantley, P. J., Appel, L. J., Hollis, J. F., Loria, C. M., ... & Samuel-Hodge, C. (2008). Comparison of strategies for sustaining weight loss: the weight loss maintenance randomized controlled trial. *JAMA*, *299*(10), 1139-1148.

Thompson, D., Brown, J. B., Nichols, G. A., Elmer, P. J., & Oster, G. (2001). Body mass index and future healthcare costs: A retrospective cohort study. Obesity Research, 9(3), 210-218.

Thygeson, N. M. (2010). A health plan perspective on worksite-based health promotion programs. *American Journal of Preventive Medicine, 38*, 226-228.

Townsend, C. K., Miyamoto, R. E., Antonio, M., Zhang, G., Paloma, D., Basques, D., ... & Kaholokula, J. K. A. The PILI@ Work Program: a translation of the diabetes prevention program to Native Hawaiian-serving worksites in Hawai ‘i. *Translational Behavioral Medicine*, 1-12.

Trogdon, J. G., Finkelstein, E. A., Hylands, T., Dellea, P. S., & Kamal-Bahl, S. J. (2008). Indirect costs of obesity: A review of the current literature. *Obesity Reviews, 9*(5), 489-500.

Trogdon, J., Finkelstein, E. A., Reyes, M., & Dietz, W. H. (2009). A return-on-investment stimulation model of workplace obesity interventions. *Journal of Occupational and Environmental Medicine, 51*(7), 751-758.

Tuomilehto, J., Lindstrom, J., Eriksson, J. G., Valle, T. T., Hamalainen, H., Ilanne-Parikka, P., … Finnish Diabetes Prevention Study Group. (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New England Journal of Medicine, 344*, 1343–1350.

Wadden, T. A., Berkowitz, R. I., Womble, L. G., Sarwer, D. B., Phelan, S., Cato, R. K., ... & Stunkard, A. J. (2005). Randomized trial of lifestyle modification and pharmacotherapy for obesity. *New England Journal of Medicine*, *353*(20), 2111-2120.

Wadden, T. A., Foster, G. D., & Letizia, K. A. (1994). One-year behavioral treatment of obesity: Comparison of moderate and severe caloric restriction and the effects of weight maintenance therapy. *Journal of Consulting and Clinical Psychology, 62*(1), 165-171.

Wang, Y. C., McPherson, K. Marsh, T., Gortmaker, S. L., & Brown, M. (2011). Health and economic burden of the projected obesity trends in the USA and the UK. The Lancet, 378(9793), 815-825.

Wang, Y., Beydoun, M. A., Liang, L., Caballero, B., & Kumanyika, S. K. (2008). Will all Americans become overweight or obese? Estimating the progression and cost of the US obesity epidemic. Obesity, 16(10), 2323-2330.

Weinhold, K. R., Miller, C. K., Marrero, D. G., Nagaraja, H. N., Focht, B. C., & Gascon, G. M. (2015). Peer Reviewed: A Randomized Controlled Trial Translating the Diabetes Prevention Program to a University Worksite, Ohio, 2012–2014. *Preventing chronic disease*, *12*(210), 1-15.

Wen, C. P., Wai, J. P. M., Tsai, M. K., Yang, Y. C., Cheng, T. Y. D., Lee, M. C., ... & Wu, X. (2011). Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study. *The Lancet*, *378*(9798), 1244-1253.

Whittemore, R. (2011). A systematic review of the translational research on the Diabetes Prevention Program. *Translational behavioral medicine*, *1*(3), 480-491.

Williams, A. E., Stevens, V. J., Albright, C. L., Nigg, C. R., Meenan, R. T., & Vogt, T. M. (2014). The results of a 2-Year randomized trial of a worksite weight management intervention. *American Journal of Health Promotion, 28*(5), 336-339.

Williams, A. E., Vogt, T. M., Stevens, V. J., Albright, C. A., Nigg, C. R., Meenan, R. T., & Finucane, M. L. (2007). Work, weight, and wellness: The 3W program: A worksite obesity prevention and intervention trial. *Obesity, 15*(S1), 16S-26S.

Williams, E. P., Mesidor, M., Winters, K., Dubbert, P. M., & Wyatt, S. B. (2015). Overweight and Obesity: Prevalence, Consequences, and Causes of a Growing Public Health Problem. *Current obesity reports*, *4*(3), 363-370.

Wilson, M. G., DeJoy, D. M., Vandenberg, R., Padilla, H., & Davis, M. (2016). FUEL your life: a translation of the Diabetes Prevention Program to worksites. *American Journal of Health Promotion*, *30*(3), 188-197.

Wing, R. R., & Jeffery, R. W. (1999). Benefits of recruiting participants with friends and increasing social support for weight loss and maintenance. *Journal of Consulting and Clinical Psychology, 67*, 132-138.

Wing, R. R., Epstein, L. H., Marcus, M. D., & Kupfer, D. J. (1984). Mood changes in behavioral weight loss programs. *Journal of Psychosomatic Research, 28*(3), 189-196.

Wing, R. R., Lang, W., Wadden, T. A., Safford, M., Knowler, W. C., Bertoni, A. G., … The Look Ahead Research Group (2011). Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care, 34*, 1481-1486.

Wolf, A. M. (1998). What is the economic case for treating obesity? Obesity Research, 6(1), 2-7.

Wyatt, S. B., Winters, K. P., & Dubbert, P. M. (2006). Overweight and obesity: prevalence, consequences, and causes of a growing public health problem. *The American journal of the medical sciences*, *331*(4), 166-174.

Yen, L., Schultz, A., Schnueringer, E., & Edington, D. W. (2006). Financial costs due to excess health risks among active employees of a utility company. *Journal of Occupational and Environmental Medicine*, *48*(9), 896-905.

Zheng, W., & Lee, S. A. (2009). Well-done meat intake, heterocyclic amine exposure, and cancer risk. *Nutrition and cancer*, *61*(4), 437-446.

Appendix: Questionnaires

Demographics Questionnaire

Please answer the following questions as completely and honestly as possible:

1. Age: _____
2. Gender: _____
3. Sexual Orientation: _____
4. Please list all of the ethnic groups that you belong to (for example, African-American, Filipino, Hawaiian, Native American, White, Hispanic, Chinese, Japanese, etc.):

   _____

5. Do you strongly identify with any of the ethnic groups that you listed above?

   ❒ No, I do not strongly identify with any of the ethnic groups I listed

   ❒ Yes, I strongly identify with: _____

6. Education Level:

   ❒ Some college

   ❒ High school diploma/GED

   ❒ Associate's Degree

   ❒ Bachelor's Degree

   ❒ Some graduate school

   ❒ Advanced degree

Food Frequency Questionnaire

These questions refer to the way you ate over the PAST MONTH

MEAT, FISH, & MAIN DISHES

In the **PAST MONTH…**

1. Did you eat fish? **YES** NO

		Always	Often	Sometimes	Never
1a.	If **YES**, how often did you have it broiled or baked?	1	2	3	4
1b.	How often did you have it fried?	1	2	3	4

2. Did you eat chicken? **YES** NO

		Always	Often	Sometimes	Never
2a.	If **YES**, how often did you have it broiled or baked?	1	2	3	4
2b.	How often did you have it fried?	1	2	3	4
2c.	How often did you take off the skin?	1	2	3	4

3. Did you eat spaghetti or pasta? **YES** NO

		Always	Often	Sometimes	Never
3a.	If **YES**, how often did you have a meatless tomato sauce?	1	2	3	4

In the **PAST MONTH…**

4. Did you eat red meat? **YES** NO

		Always	Often	Sometimes	Never
4a.	If **YES**, how often did you eat only small portions?	1	2	3	4
4b.	How often did you trim the visible fat?	1	2	3	4

		Always	Often	Sometimes	Never
5.	How often did you have a vegetarian dinner?	1	2	3	4

6. Did you eat fish or chicken instead of red meat? **YES** NO

		Always	Often	Sometimes	Never
6a.	If **YES**, how often did you eat fish or chicken instead of red meat?	1	2	3	4

MILK AND CHEESE

In the **PAST MONTH…**

7. Did you drink milk or use milk on cereal? **YES** NO

		Always	Often	Sometimes	Never
7a.	If **YES**, how often was it very low (1%) or non-fat skim milk?	1	2	3	4

8. Did you eat cheese (include sandwiches or in cooking)? **YES** NO

		Always	Often	Sometimes	Never
8a.	If **YES**, how often was it specially made, low fat (diet) cheese?	1	2	3	4

9. Did you eat frozen desserts (ice cream sherbet, etc.)? **YES** NO

		Always	Often	Sometimes	Never
9a.	If **YES**, how often did you choose frozen yogurt, sherbet, or non-fat ice cream instead of regular ice cream?	1	2	3	4

BREADS, ROLLS, MUFFINS, AND CEREALS

In the **PAST MONTH…**

16. Did you eat breads, rolls, or muffins? **YES** NO

		Always	Often	Sometimes	Never
16a.	If **YES**, how often did you eat breads, rolls, or muffins without butter or margarine?	1	2	3	4

FOOD PREPARATION

In the **PAST MONTH…**

17. Did you cook or prepare meals or snacks? **YES** NO

	Always	Often	Sometimes	Never
17a. If **YES**, how often did you use Pam or other non-stick spray instead of oil, margarine or butter	1	2	3	4

18. Did you use mayonnaise? **YES** NO

	Always	Often	Sometimes	Never
18a. If **YES**, how often did you use diet, low calorie mayonnaise instead of regular mayonnaise?	1	2	3	4

FRUITS, VEGETABLES, AND SALADS

In the **PAST MONTH…**

10. Did you eat cooked vegetables? **YES** NO

	Always	Often	Sometimes	Never
10a. If **YES**, how often did you put butter or margarine on the vegetables?	1	2	3	4

11. Did you eat potatoes? **YES** NO

	Always	Often	Sometimes	Never
11a. If **YES**, how often were they fried? (French fries, hash browns)?	1	2	3	4
11b. How often were they boiled or baked?	1	2	3	4
11c. How often did you eat potatoes with butter, margarine, or sour cream?	1	2	3	4

12. Did you eat green salads? **YES** NO

	Always	Often	Sometimes	Never
12a. If **YES**, how often did you use no dressing?	1	2	3	4
12b. How often did you use low-calorie, diet dressing?	1	2	3	4

		Always	Often	Sometimes	Never
13.	How often did you eat beans, peas, or lentils as a vegetable or main course?	1	2	3	4
14.	How often did you eat at least two vegetables (not a green salad) at dinner?	1	2	3	4
15.	How often did you eat a vegetable (not green salad) at lunch?	1	2	3	4

International Physical Activities Questionnaire

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

☐ No moderate physical activities → ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Impact of Weight on Quality of Life Questionnaire- Lite Version

Please answer the following statements by circling the number that best applies to you in the past week. Be as open as possible. There are no right or wrong answers.

Physical Function	Always True	Usually True	Sometimes True	Rarely True	Never True
1. Because of my weight I have trouble picking up objects.	5	4	3	2	1
2. Because of my weight I have trouble tying my shoes.	5	4	3	2	1
3. Because of my weight I have difficulty getting up from chairs.	5	4	3	2	1
4. Because of my weight I have trouble using stairs.	5	4	3	2	1
5. Because of my weight I have difficulty putting on or taking off my clothing.	5	4	3	2	1
6. Because of my weight I have trouble with mobility.	5	4	3	2	1
7. Because of my weight I have trouble crossing my legs	5	4	3	2	1
8. I feel short of breath with only mild exertion.	5	4	3	2	1
9. I am troubled by painful or stiff joints	5	4	3	2	1
10. My ankles and lower legs are swollen at the end of the day.	5	4	3	2	1
11. I am worried about my health.	5	4	3	2	1

Self-esteem	Always True	Usually True	Sometimes True	Rarely True	Never True
1. Because of my weight I am self-conscious.	5	4	3	2	1
2. Because of my weight my self-esteem is not what it could be.	5	4	3	2	1

3. Because of my weight I feel unsure of myself.	5	4	3	2	1
4. Because of my weight I am afraid of being rejected.	5	4	3	2	1
5. Because of my weight I avoid looking in mirrors or seeing myself in photographs.	5	4	3	2	1
6. Because of my weight I am embarrassed to be seen in public places.	5	4	3	2	1
7. Because of my weight I feel sad.	5	4	3	2	1

	Always True	**Usually True**	**Sometimes True**	**Rarely True**	**Never True**
Sexual Life					
1. Because of my weight I do not enjoy sexual activity.	5	4	3	2	1
2. Because of my weight I have little or no sexual desire	5	4	3	2	1
3. Because of my weight I have difficulty with sexual performance.	5	4	3	2	1
4. Because of my weight I avoid sexual encounters whenever possible.	5	4	3	2	1

Public Distress	**Always True**	**Usually True**	**Sometimes True**	**Rarely True**	**Never True**
1. Because of my weight I experience ridicule, teasing, or unwanted attention.	5	4	3	2	1
2. Because of my weight I worry about fitting into seats in public places (e.g.,theaters, restaurants, cars, or airplanes).	5	4	3	2	1
3. Because of my weight I worry about fitting through aisles or turnstiles	5	4	3	2	1

4. Because of my weight I worry about finding chairs that are strong enough to hold my weight.	5	4	3	2	1
5. Because of my weight I experience discrimination by others.	5	4	3	2	1

Work	**Always True**	**Usually True**	**Sometimes True**	**Rarely True**	**Never True**
1. Because of my weight I have trouble getting things accomplished or meeting my responsibilities	5	4	3	2	1
2. Because of my weight I am less productive than I could be.	5	4	3	2	1
3. Because of my weight I don't receive appropriate raises, promotions or recognition at work.	5	4	3	2	1
4. Because of my weight I am afraid to go on job interviews.	5	4	3	2	1

Short Version of the Body Shape Questionnaire

We would like to know how you have been feeling about your appearance over the past two weeks. Please read each question and circle the appropriate number. Please answer all the questions.

	Never	**Rarely**	**Sometimes**	**Often**	**Very Often**	**Always**
1) Have you been so worried about your shape that you have been feeling that you ought to diet?	1	2	3	4	5	6
2) Has being with thin people made you feel self-conscious about your shape?	1	2	3	4	5	6
3) Have you ever noticed the shape of other people and felt that your own shape compared unfavorably?	1	2	3	4	5	6
4) Has being undressed, such as when taking a bath, made you feel fat?	1	2	3	4	5	6
5) Has eating sweets, cakes, or other high calorie food made you feel fat?	1	2	3	4	5	6
6) Have you felt excessively large and round?	1	2	3	4	5	6
7) Have you felt ashamed of your body?	1	2	3	4	5	6
8) Has worry about your shape made you diet?	1	2	3	4	5	6
9) Have you thought that you are the shape you are because you lack self control?	1	2	3	4	5	6
10) Have you worried about other people seeing rolls of fat around your waist and stomach?	1	2	3	4	5	6
11) Have you felt it is not fair that other people are thinner than you?	1	2	3	4	5	6
12) Has seeing your reflection (e.g.,in a mirror of shop window) made you feel bad about your shape?	1	2	3	4	5	6
13) Have you been particularly self-conscious about your shape when in the company of other people?	1	2	3	4	5	6
14) Has worry about your shape made you feel you out to exercise?	1	2	3	4	5	6

Weight Management Support Inventory

Directions: Below is list of things that people in your life may do or say to help you with your diet or attempt at weight loss. "Others" includes family members, friends, and any other important people in your life.

Please rate how often the following this have happened over the past 4 weeks using this scale:

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

ALSO rate how helpful each thing was with your diet:

1	2	3	4	5
Not at all helpful		Somewhat helpful		Extremely helpful

For examples: If those close to you have reminded you almost every day over the past few weeks to watch your diet, but this has only been a little helpful to you, then you would probably rate it as a "4" (several times per week) on the frequency scale, and a "2" (only a little) on the helpfulness scale.

1) Others remind me to watch what I eat.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

2) Other members of my household avoid buying junk food or having it in the house.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/does not apply		Somewhat helpful		Extremely helpful

3) Others tell me that they're concerned about my eating habits.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

4) Others split a dessert or meal with me to help me to reduce the amount I eat.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

5) Others tell me that I look like I'm in better shape.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

6) Other go walking or jogging with me for exercise.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

7) Others in my household eat low calorie/ low fat foods even though they aren't trying to lose weight.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

8) Others ask what exercises I did to lose weight.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

9) Others compliment me when they notice I've lost weight.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

10) Others tell me ways to change my exercise routine so I won't get bored.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

11) Others tell me that they are confident that I can lose weight.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

12) Others tell me about different types of exercise I should do to get a balanced and complete work out.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

13) Others compliment me on sticking to an exercise routine.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

14) Others ask how I lost weight because they're impressed with my success.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

15) Others play sports or exercise with me.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

16) Others tell me about the calorie or fat content of foods

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

17) Others tell me they are impressed with how physically fit I am.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

18) Others give me pep talks about sticking to my diet.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

19) Others go on a diet with me.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

20) Others tell me about the exercises that have helped them to lose weight.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

21) Others tell me about foods that I could try that are low in fat and calories.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

22) Others listen to my concerns about the difficulty of dieting.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

23) Others avoid eating junk food or fattening foods in front of me.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

24) Others remind me to exercise or to go to the gym.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

25) Others tell me the best way to do exercises for weight loss.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

26) Others tell me about the things that they have done to lose weight.

1	2	3	4	5
Never	1 or 2 times a month	1 time per week	Several times a week	Daily

1	2	3	4	5
Not helpful/ does not apply		Somewhat helpful		Extremely helpful

Treatment Satisfaction

Please answer the following questions using this scale:

1	2	3	4	5
Very Satisfied	Somewhat satisfied	Neither satisfied nor dissatisfied	Somewhat dissatisfied	Very dissatisfied

___ How satisfied are you with the Lifestyle Balance program in general?

_____ How satisfied are you with the changes you have maintained in your eating?

_____ How satisfied are you with the changes you have maintained in your physical activity?

_____ How satisfied are you with your weight loss or weight maintenance so far?

Did you receive any additional weight loss treatment(s) during the last 6 months of the Lifestyle Balance program?

[ ] YES
[ ] NO

If so, please specify:_____

Any comments or feedback you might like to add:

_____

_____

_____